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MODEL 41-3A
SERVICE ANALYZER
INSTALLATION AND OPERATION
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DIVISION OF **tau-tron inc.**

A UNIT OF GENERAL SIGNAL

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MODEL 41-3A

SERVICE ANALYZER

INSTALLATION AND OPERATION

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1. INTRODUCTION

1.01 This manual provides instructions for the installation and operation of the Northeast Electronics Model 41-3A Service Analyzer, NED 0041-13-909. As shown in Table A below, the current 0041-13-909 Model 41-3A combines and replaces the older 0041-13-900 basic unit and its 0041-13-901 MF option. As before, the basic Model 41-3A unit is programmed and operated via its front panel controls.

1.02 When equipped with an Expanded Remote Control (ERC) Option, the Model 41-3A can also be programmed and operated from a local/remote keyboard terminal or by a computer. This ERC option is available as a factory-installed feature; or, it can be provided as a kit for retrofitting a basic Model 41-3A. (Notice that an additional kit, the C-Message Noise & 1-kHz Level Measurement Option, is available as an augmentation to the ERC option.) Instructions for operating the Model 41-3A w/ERC are provided by manual A0041-13-605.

TABLE A

MODEL 41-3A PRODUCT STRUCTURE

NSSD PART NUMBER	DESCRIPTION
0041-13-909	Model 41-3A basic unit with no options (this unit replaces the older 0041-13-900 basic unit and its 0041-13-901 MF option)
0041-13-910	Model 41-3A w/Expanded Remote Control (ERC) Option (this unit replaces the older 0041-13-905 unit and associated 0041-13-906 MF Option)
0041-13-911	Expanded Remote Control Option retrofit kit for basic 0041-13-909/900 unit (replaces the old 0041-13-904 remote control retrofit kit)
0041-13-912	C-Message Noise & 1-kHz Level Measurement Option (operates only when installed with the ERC Option)

TABLE A (Cont)

Notes:

1. The 0041-13-909 basic unit is identified by the following decal (located above rear panel filter housing).

Model 41-3A with MF
0041-13-909

2. The Model 41-3A w/ERC is identified by a second decal (above the first decal).

Model 41-3A Expanded Remote
0041-13-910/11

3. If the Model 41-3A also has the C-Msg/1-kHz Level option, it is identified by a third decal (above the second decal).

Model 41-3A C-Msg/1-kHz Level
0041-13-912

A. General Description

1.03 The basic Model 41-3A analyzer combines the functions of a routiner, automatic dialer, and call-through test set. It provides central office and trunk network routing with test call failure analysis. The 41-3A can be programmed to

- (a) Dial a number assigned to its own internal test line, or any other test line
- (b) Analyze the progress and results of each call attempted
- (c) Store and display the number of calls attempted, the number of calls that tested OK, and the number of failures.

1.04 The 41-3A can also be programmed to halt and to hold switched connections for troubleshooting specific failures.

1.05 Originating Lines

1.06 The Model 41-3A provides 16 wet-loop, 600/900 ohm, 310-type jacks for 2-lead T/R or 3-lead T/R/S telephone line connections. These 16 rear-panel multiple circuit selector inputs are divided into two channel groups. The 41-3A scans and checks for idle/busy until an idle line is found. The line is checked for acceptable call completion characteristics. Dialing continues on one

channel while the other channel is held for tracing and troubleshooting of a failed line.

1.07 The 16 call origination ports allow several line finder groups or similar parallel switching arrangements to be exercised in a single routing operation.

1.08 A distinctive trace tone can be coupled onto a held line to facilitate trouble location. A talk button and jacks for a type 52A headset allow voice communication over the held line. Also, external test equipment can be connected to the 41-3A for either a bridged or terminating connection to the held line.

1.09 Built-in Test Line

1.10 The Model 41-3A has an internal test line which can be wired to an incoming test line to receive calls dialed out by the 41-3A. Thus, operation of the Model 41-3A need not tie up regular telephone office test lines.

1.11 The built-in test line is tripped to off-hook by a 20 to 60-Hz ring signal across its T/R leads. When tripped, the test line couples a 1-kHz tone to the circuit for transmission tests. The sleeve lead can be monitored for an active (busy) lead condition. A call which successfully trips the built-in test line records a test-OK result; otherwise, an incoming circuit fault is recorded.

1.12 Failure Tabulation

1.13 The following types of call completion failures can be programmed for detection and tabulation.

- No (or late) start dial signal (dial tone or wink-type signal)
- Open C-lead after line seizure
- False T/R reversal supervision during dialing (discloses reversed wipers in SXS switch trains and faulty message accounting equipment)
- Reorder
- Station busy
- Reorder plus false answer supervision
- Busy plus false answer supervision
- Late or no answer supervision after dialing
- Incoming circuit fault (call does not reach internal test within a specified time after dialing)
- No (or late) 1-kHz tone received from a dialed signal source
- Received 1-kHz tone level is below expected measured level (EML) by an amount greater than a low limit value (discloses excessive transmission loss)

- Received 1-kHz tone level is above expected measured level (EML) by an amount greater than a high limit value (discloses attenuation pad problems and excessive gain).

1.14 In addition to the above failure categories, the Model 41-3A provides total counts for

- (a) Total calls attempted
- (b) Total calls attempted on channel A lines
- (c) Total calls attempted on channel B lines
- (d) Total calls that tested OK.

1.15 Dialing Program

1.16 The 41-3A dialer can be programmed for dial pulse, Touch-Tone®, or multifrequency dialing with selectable dialing speed, percent break (or percent tone), interdigit time, and other parameters. The dialing sequence is initiated by a programmed start dial command, and special pause commands may be programmed with the dial digits. The dial program allows test calling through PBX, CCSA, and Dial Tandem equipment.

B. Specifications

1.17 Specifications for the Model 41-3A are listed in Table B.

TABLE B
MODEL 41-3A SPECIFICATIONS

ORIGINATING LINES	
Line Capacity	8 lines maximum on each of two channels (lines connect to type 310 jacks on rear panel)
Line Type	Wet loop type; T/R leads for dedicated circuits, T/R/S leads for non-dedicated circuits with ground control on S lead. Line impedance can be either 600 or 900 ohms.
Sleeve Lead	
Busy Condition Recognized	Ground or any potential more positive than -7 V
Idle Condition Recognized	Open circuit or any potential more negative than -11 V (4 V of hysteresis provided to prevent indecision)
Circuit Busy-to-Reselect Circuit Time	100 ± 1 ms
Line Seizure (off-hook)	Active hold with 15 mA.

TABLE B (Cont)

DIALING	
Type	Dial pulsing (DP), Touch-Tone (TT), or multifrequency (MF)
Digit Capacity	Up to 32 digits and instructions for programmed wait-for-start dial (WSD) stops.
Digit Entry	Front panel keyset enters the digits, WSD instructions and end of number (EON) instruction.
Dial Pulsing	
Dial Speed Range	Selectable 1 to 99 pps in 1-pps increments
Dialing Speed Accuracy	$\pm 0.1\%$ for 1 to 30 pps range
Percent Break Range	1 to 99% in 1% increments
Percent Break Accuracy	$\pm 1\%$ for 35% to 85% percent break range over a 1 to 30 pps dialing speed range
Interdigital Time Range	1 to 999 ms in 1-ms increments
Interdigital Time Accuracy	Better than ± 1 ms
Transient Suppression	325 ± 25 Vdc
Touch-Tone Dialing	
Frequency	Pair of frequencies, one from a low frequency group and the other from a high frequency group.
Frequency Accuracy	$\pm 1\%$
Single Frequency Harmonic Distortion	Less than 3% over a 30-kHz bandwidth
Single Frequency Output Level	-6.0 ± 0.5 dBm into 900 ohms
Dialing Speed Range	1 to 99 digits per second in 1 digit per second increments
Dialing Speed Accuracy	$\pm 0.1\%$ for 1 to 30 digit per second range
Tone Duration Percentage Range	1 to 99% in 1% increments
Tone Duration Percentage Accuracy	$\pm 1\%$ for 35% to 85% tone duration range over 1 to 30 digit per second dialing speed range

TABLE B (Cont)

Multifrequency Dialing	
Type	Standard R1 MF pulsing (KP and ST tones transmitted at the proper times)
Frequency Accuracy	$\pm 1\%$
Single Frequency Harmonic Distortion	Less than 3% over a 30-kHz bandwidth
Single Frequency Output Level	-6.0 dBm $\pm$ 0.5 dB into 600 ohms
Dialing Speed Range	1 to 99 digits per second in 1 digit per second increments
Dialing Speed Accuracy	$\pm 0.1\%$ for 1 to 30 digit per second range
Tone Duration Percentage Range	1 to 99% in 1% increments
Tone Duration Percentage Accuracy	$\pm 1\%$ for 35% to 85% tone duration range over 1 to 30 digit per second dialing speed range
Twist	.1 dB or less
DETECTION CRITERIA	
Answer Supervision	T/R lead reversal lasting longer than approximately 312 ms
Open C-lead	Loss of C-lead ground lasting longer than 512 ms Note: When an open C-lead is detected, the Model 41-3A holds the switched connection with approximately 180 mA of sleeve current.
1-kHz Level Detector	
Frequency Range	990 to 1020 Hz
No Tone Threshold	-31 ± 1 dBm from 900/600 ohms
Response Time	2 ± 0.5 seconds
Level Limit Accuracy	± 0.5 dB from +10 to -10 dBm. ± 1 dB from -11 to -31 dBm.
Busy/Reorder Detector	
Frequency Range	200 to 650 Hz
Sensitivity	-30 dBm from 900/600 ohms
Busy Pulse Modulation Rate	45 to 75 ipm
Reorder Pulse Modulation Rate	100 to 140 ipm
On/Off Level Ratio	Greater than 6 dB
Number of Interruptions	3 for busy tone, 6 for reorder tone
Tone on Duty Cycle	20 to 80%

TABLE B (Cont)

DETECTION CRITERIA (Cont)	
Wink/Delay Dialing Detection	Reversed tip/ring polarity present on the line under test for at least 128 milliseconds followed by a return to normal polarity that lasts for at least 200 milliseconds. Note: The line under test can be in either the normal or reversed state prior to seizure.
INCOMING CIRCUIT TEST LINE	
Pre-Trip Impedance	Approximately 47 kohms at 20 Hz
Trip Impedance	Approximately 850 ohms at 20 Hz
Trip Criteria	20-60 Hz ringing voltage across T/R leads at 65 volts rms or greater
Quantity of Rings to Trip	1 lasting for more than 600 ms
Sleeve Active (Busy) Condition Recognized	Open circuit, ground, or any potential more positive than -7 V
Sleeve Inactive (Idle) Condition Recognized	Any potential more negative than -11 V (4 V of hysteresis provided to prevent indecision)
Signal Output	$1004 \pm 10\text{ Hz}$ at 0 dBm into 900 ohms
INTERNAL TRACE TONE	
Frequency	$1165 \pm 500\text{ Hz}$, gated on/off at 4 Hz rate (240 ipm)
Tone-On Level	Approximately 0 dBm into 900 ohms
Loop Holding Resistance	$900 \pm 90\text{ ohms dc}$
DATA STORAGE	
16 Data Registers	Total tests Tests on Channel A Tests on Channel B No dial tone (and/or no wink) Open C-lead Reversal during dialing Reorder and answer Busy and answer Reorder (and no answer) Busy (and no answer) Low level No 1-kHz tone High level No answer Incoming circuit fault Test OKs

TABLE B (Cont)

DATA STORAGE (Cont)	
Storage Capacity	9999 events per register <i>Note:</i> Instant recall is provided via individual read-out switches. An over-range indication is shown if a register count exceeds 9999 (total tests register) without affecting the contents of other registers.
INPUT POWER	105 to 120 or 215 to 240 Vrms, 50 to 60 Hz, approximately 60 watts
OPERATING ENVIRONMENT	
Temperature	+32°F to +122°F (0°C to +50°C)
Humidity	0% to 90% relative
MECHANICAL	
Size	9 in. h × 17 in. w × 18 in. d (23 cm × 43 cm × 46 cm)
Weight	Approximately 40 pounds (18.2 kg)

C. Service Information

1.18 Complete warranty information is contained in the purchase order agreement under terms and conditions of sale. Briefly, Northeast Electronics Test Instruments are warranted to the original purchaser for one year from the date of shipment.

1.19 If a product fails to perform as expected, it is recommended that you call our Factory Service Center in Concord, New Hampshire at (603) 224-6511. Our service personnel may be able to assist you by telephone.

1.20 Should it be necessary to return a product, you will need a Return Material Authorization (RMA) Number. This number assists us in tracking your repair order. RMA numbers are issued by the Service Center personnel.

1.21 Equipment returned for repair must be accompanied by the following information:

- Purchase Order Number (if out of warranty)
- Bill-to address (if out of warranty)
- Ship-to address
- Description of problem.

D. Maintenance

1.22 The Model 41-3A requires no routine maintenance. Repairs and adjustments of the test set should be made only as required.

2. INSTALLATION

A. Inspection

2.01 After unpacking the Model 41-3A, verify that the unit has been shipped with an 8-foot, 3-wire ac power cord. Examine the exterior of the unit for visible damage caused in shipment.

B. Mounting

2.02 The Model 41-3A is a portable instrument which can be placed on a convenient worktable or shelf. The unit is not equipped for permanent rack mounting. If rack mounting is desired, mount a shelf in the rack to support the Model 41-3A.

2.03 Major dimensions of the Model 41-3A are shown in Fig. 1. A clearance of five inches in the back of the unit is required for cable connections and the cool air inlet. Also, one inch clearance at the top and sides is needed for air flow.

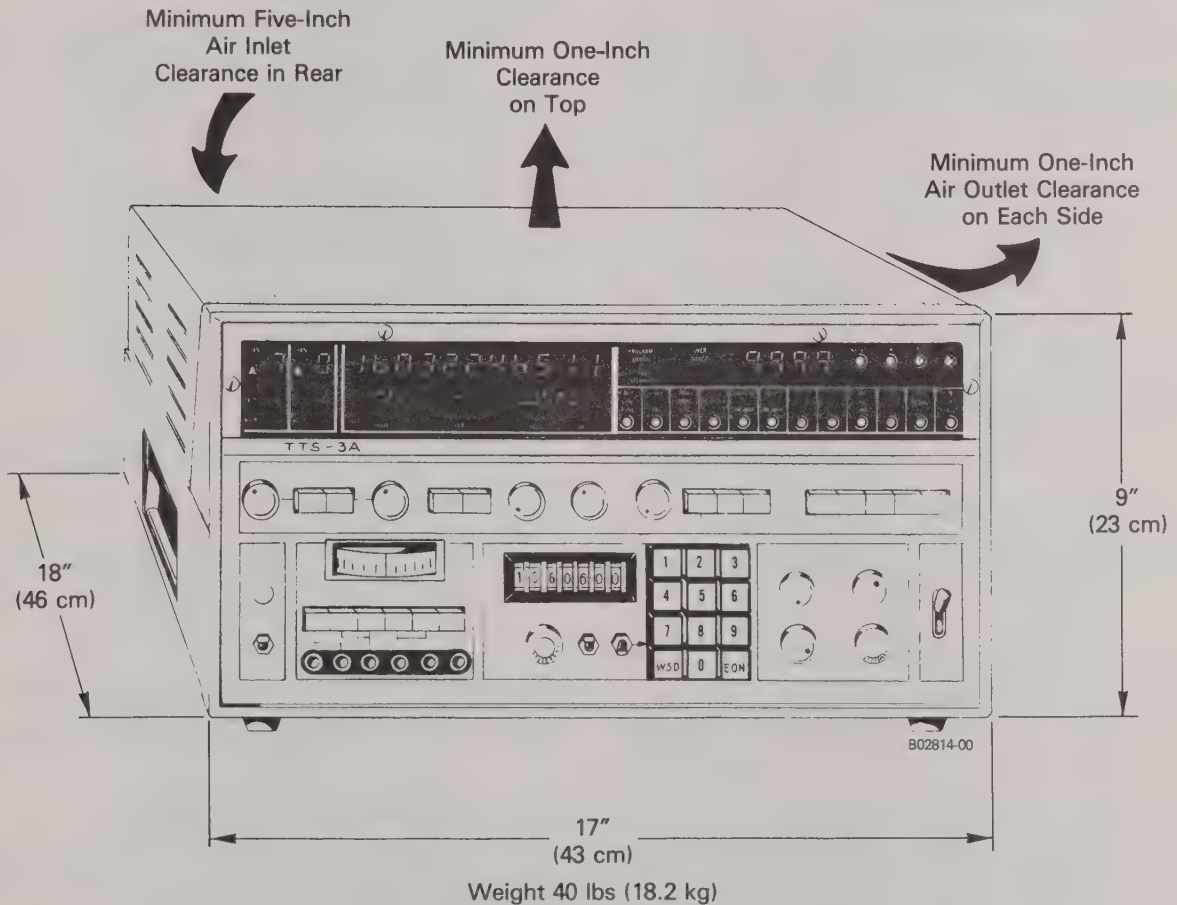


Fig. 1—Air Flow Requirements

C. Power Connection

2.04 The unit operates on 105 to 120 Vac or 215 to 240 Vac, 50 to 60 Hz power. Be sure the rear panel SELECT VOLTAGE switch is properly positioned for the power source used.

Caution: Two-ampere slow blow fuses, required for 115-volt operation, are installed in the rear panel fuse holders at the factory. These fuses must be changed to 1-ampere slow-blow when 230-volt operation is selected.

2.05 The power cord supplied with the unit has a standard NEMA 3-prong, wall-outlet type plug at one end. The other end mates with a 3-prong connector located on the unit's rear panel. The Model 41-3A consumes about 60 watts of power.

Note: Besides meeting safety standards, the NEMA ground pin on the power cord establishes a common reference between telephone office ground and the 41-3A's chassis ground. Do not modify this connection as it will affect operation of the unit.

D. Verification Procedure

2.06 The following procedure verifies the operational status of the Model 41-3A prior to a permanent installation of the unit. No telephone lines should be connected to the unit during this procedure.

2.07 Initial Settings

- (1) Set the POWER switch off (down position).
- (2) Release all press-to-engage switches.
- (3) Set all timing controls to nominal (12 o'clock) positions.
- (4) Set MODE switch to IDLE.
- (5) Set LEAK/LOOP switches to NORM.
- (6) Set TT/DP/MF to TT.
- (7) Set DIALER PROGRAM thumbwheel switches as follows:

SPEED = 10 (i.e., 10 digits per second)

%BRK = 50 (i.e., 50% tone-on period).

Note: IDT (DP) is not used in this procedure.

- (8) Set RESET/→/NORM switch to NORM.
- (9) Set MASTER and DIALING VOLUME controls to midrange.
- (10) Insert a dummy (not wired) 310-type plug into front panel jack LINE CONTROL A.

2.08 Check Settings

- (1) Set the POWER switch on. The POWER INTERRUPT indicator lights, and all digital readouts display digit 8. Except for the channel A and B TEST, TRACE, and BUSY indicators, all other indicators light.

- (2) Press the RESET pushbutton for at least two seconds. The POWER INTERRUPT indicator stops flashing, the TEST RESULTS readout blanks out, and the following indicators light:

- (a) Channel A IDLE
- (b) Channel B IDLE
- (c) PROGRAM ERROR
- (d) TEST PROGRESS ON-HOOK (basic unit only).

Note: If the Model 41-3A is equipped with the Expanded Remote Control Option, its TEST PROGRESS IDLE indicator lights instead of the TEST PROGRESS ON-HOOK indicator.

- (3) Engage the TEST A, DELAY, and ANS SUP pushbuttons. The PROGRAM ERROR and TEST PROGRESS ON-HOOK indicators go out, and the TEST PROGRESS IDLE indicator lights (basic unit only).

Note: If the Model 41-3A is equipped with the Expanded Remote Control Option, its TEST PROGRESS IDLE indicator remains on.

- (4) Set RESET/→/NORM switch to RESET, then to → (load). The TEST PROGRESS readout goes blank.
- (5) Use the keyset to enter sequence 1234567890EON into the dialer. The entered digits are displayed at half brightness in the TEST PROGRESS readout.
- (6) Set RESET/→/NORM switch to NORM.
- (7) Ensure that the START AFTER switch is set for 4 seconds.
- (8) Engage the FAULT pushbutton.
- (9) Set MODE switch to AUTO. The Model 41-3A places a single test call. After a short pause, the following results occur:

- (a) TEST A indicator lights.
- (b) The TEST PROGRESS indicators show the operational status of the 41-3A, and each dialed digit is displayed in full brightness.
- (c) Touch-Tone® signals can be heard from unit's speaker (adjust DIALING VOLUME control as necessary).

(d) The NO ANSWER and SYSTEM HELD indicators light after the DIALING COMPLETED WAITING FOR TEST RESULTS period ends.

(e) The 41-3A emits an alarm tone.

Note: If alarm volume is unsatisfactory refer to paragraph 2.09.

(f) The TEST RESULTS readout displays a digit 1.

(10) Hold the NO ANSWER pushbutton depressed. The TEST RESULTS readout shows a digit 1.

(11) Hold the NO DIAL TONE pushbutton depressed. The TEST RESULTS readout goes blank.

(12) If desired, another test call can be placed by momentarily setting the MODE switch to IDLE, then back to AUTO. Set the POWER switch off when satisfied with the Model 41-3A's performance.

(13) Successful completion of the above steps indicates the 41-3A unit has been shipped without internal damage and is ready for installation and use.

E. Alarm Volume Adjustment

2.09 The following adjustment should be made only if the alarm volume is unsatisfactory.

- (1) Set POWER switch to off.
- (2) Remove the Model 41-3A's top cover by removing a retaining screw on each side of the unit's rear corners.
- (3) Place Card 5 (ejector marked 5) on a suitable extender board.
- (4) Ensure no telephone lines are connected to the Model 41-3A and perform the checkout procedure of paragraph 2.08, stopping at Step 9.
- (5) Refer to Fig. 2 and adjust the alarm volume potentiometer until the volume is satisfactory.
- (6) Set MODE switch to IDLE.
- (7) Set POWER switch to off.
- (8) Replace Card 5 and the Model 41-3A's top cover.

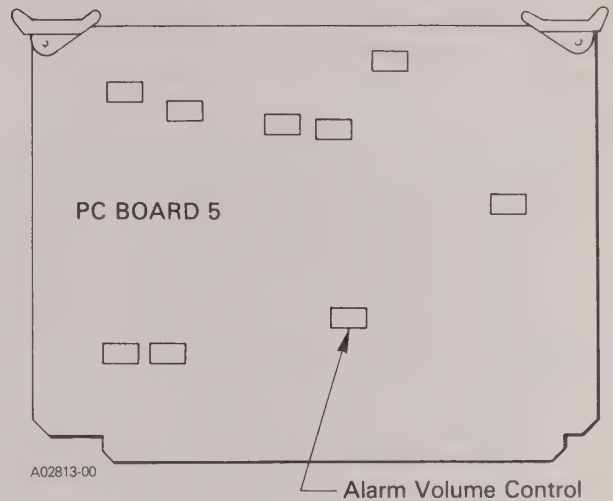


Fig. 2—Alarm Volume Adjust Control

F. Telephone Line Connections

2.10 As shown in Fig. 3, up to 16 telephone lines can be connected to the Model 41-3A's rear panel. Telephone lines can be either 600 or 900 ohm, wet-loop type, T/R or T/R/S circuits, connected via standard 310 type jacks.

Note: When the Model 41-3A is used in a #5 crossbar office, use only T/R circuit connections. Do not connect the sleeve leads of the circuits under test to the Model 41-3A.

2.11 Telephone line connections are normally distributed evenly between channels A and B. This allows continued testing on the other channel while one channel is held for troubleshooting.

2.12 Two front panel 310 type jacks are also provided. When a telephone line is connected to either of these jacks, the rear panel jack field is disabled.

2.13 When the Model 41-3A's internal test line is used, an incoming circuit must connect to the rear panel INCOMING CIRCUIT terminals (see Fig. 3). These connections can be: (a) T/R/S, (b) T/R only, or (c) S only.

2.14 When tripped to off-hook by a 20 to 60-Hz ringing signal, the internal test line couples an internal 1-kHz tone source across the T/R leads of the incoming circuit.

2.15 The internal test line is factory strapped for operation with T/R/S or T/R circuit connections. The completion of a call to this test line is recognized by the Model 41-3A when it detects a ringing signal while the S lead is (a) open, (b) grounded, or (c) at a potential more positive than -7 Vdc. Even when ringing is detected, the 41-3A does not consider a call completed if a potential more negative than -11 Vdc is present on the S lead.

2.16 If it is necessary to operate the Model 41-3A with only an S lead connection to the incoming circuit, the factory strapping must be changed. The following steps enable the 41-3A to recognize completed calls with only an S-lead connection.

- (1) Remove the unit's top cover by removing a retaining screw on each rear corner.
- (2) Locate the incoming circuit pc board (96826) mounted on the unit's left rear panel.
- (3) Locate the pc connection between terminals A and C, and cut this connection. (See Fig. 4.)
- (4) Install a jumper wire between terminals B and C.
- (5) Replace the Model 41-3A's top cover.

2.17 When strapped to operate with only an S lead connection to the incoming circuit, the Model 41-3A recognizes a completed call to the internal test line when the S lead is open or grounded, or has a potential more positive than -7 Vdc. The 41-3A does not consider a call completed if a potential more negative than -15 Vdc is present on the S lead.

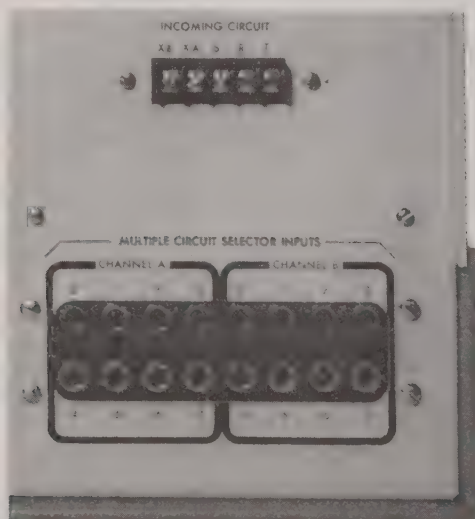


Fig. 3—Telephone Line Connectors

G. Tip/Ring Polarity Check

2.18 After the above telephone line connections are completed, a check is necessary to ensure the Model 41-3A is compatible with the tip/ring polarity of the call origination lines. This check is performed in the following steps.

- (1) Engage both TEST A and B pushbuttons.

Note: When a single front panel telephone line connection is used, engage only the corresponding TEST A or TEST B pushbutton.

- (2) Engage both DELAY and ANS SUP pushbuttons.
- (3) Set the MODE switch to IDLE.
- (4) Set the POWER switch to ON.
- (5) Press the RESET pushbutton for at least two seconds. Wait for the Model 41-3A to find an idle call origination line. The idle line number is indicated in the LINE DISPOSITION display.

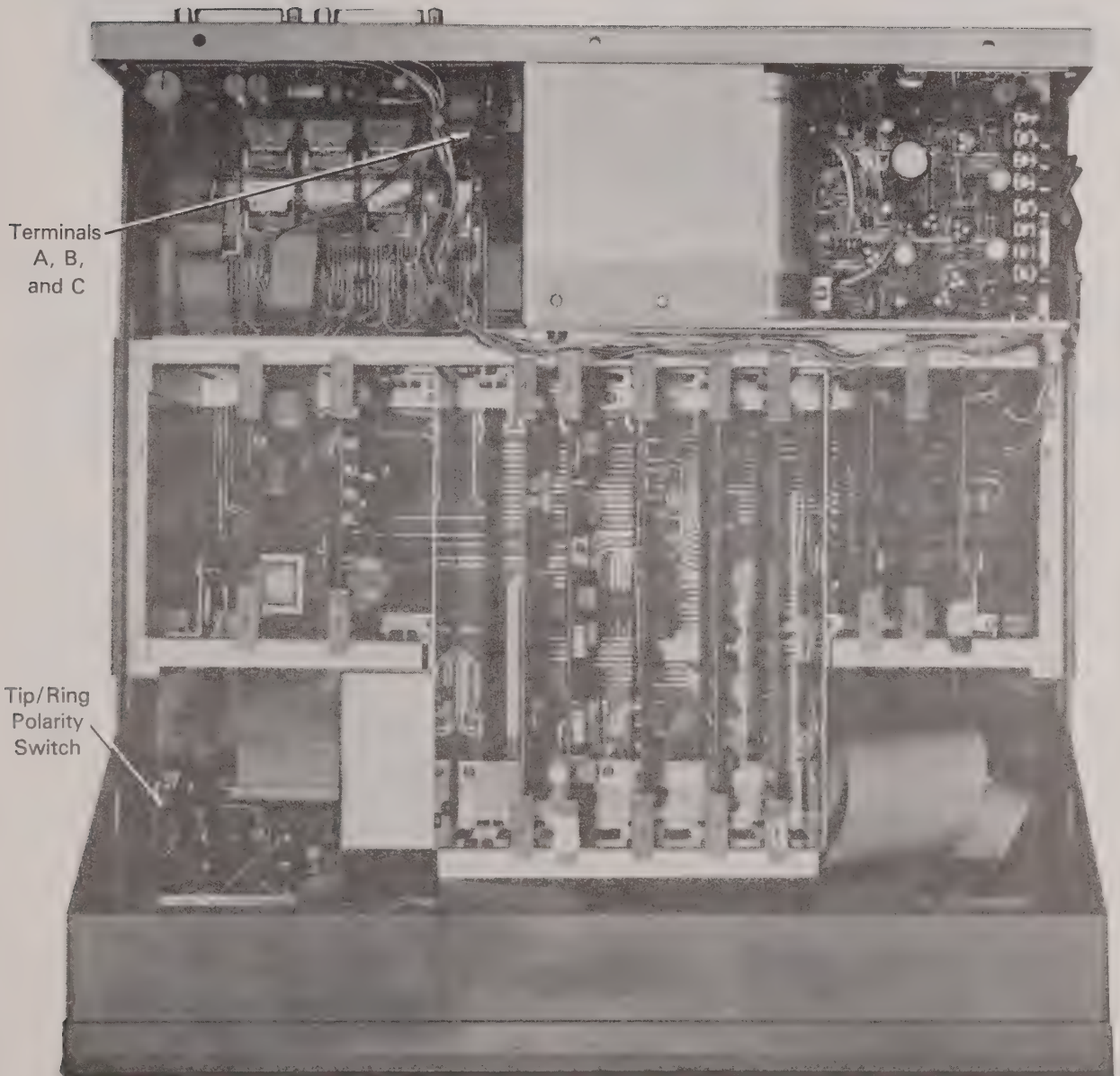
(6) Observe the front panel LINE CONTROL meter. When this meter reads almost full scale to the right (NORMAL), the Model 41-3A's polarity is compatible with the tip/ring polarity of the call origination lines; no further action is required other than proceeding to Step 10. If the meter reads almost full scale to the left (REVERSE), the Model 41-3A's polarity must be changed; go to Step 7.

Note: Some loop trunks are in the off-hook state when idle. If this type of trunk is used and the meter reads almost full scale to the left (REVERSE), the Model 41-3A's polarity is compatible; go to Step 10. If the meter reads almost full scale to the right (NORMAL), go to Step 7.

- (7) Remove the 41-3A's top cover by removing the retaining screw on each side of the unit's rear corners.
- (8) Refer to Fig. 4 and locate the unit's internal tip/ring polarity switch.
- (9) Set the polarity switch so the line control meter reads almost full scale to the right.

Note: If off-hook loop trunks are used, set the polarity switch so the line control meter reads almost full scale to the left.

- (10) Set the POWER switch off and replace the 41-3A's top cover. The tip/ring polarity check is complete and the Model 41-3A is ready for operation.



3. OPERATION

3.01 General operating instructions are presented first, followed by example applications. The operating instructions provide the information needed to program the Model 41-3A via its front panel controls. The example applications illustrate the use of the 41-3A for specific routing operations. For reference purposes, front and rear controls are tabulated last.

Note: Proper operation of the Model 41-3A requires the tip/ring polarity check, given in paragraph 2.18, to be made at the time of installation. If installation instructions have been followed, this check has been made.

A. Programming Instructions

3.02 Initial Settings

3.03 Connect the Model 41-3A to a source of ac power and to telephone lines as described under the installation instructions. Then make the following initial control settings.

- (1) POWER switch off
- (2) All press-to-engage switches released
- (3) LEAK/LOOP switches to NORM
- (4) TT/DP/MF switch to DP
- (5) RESET/→/NORM switch to NORM
- (6) MODE switch to IDLE
- (7) SYSTEM TIMING and MON controls to 12 o'clock
- (8) START DIAL COMMAND controls to 12 o'clock
- (9) DB switches to 12 o'clock.

3.04 Power-up and Reset

3.05 Place the POWER switch to ON and press the RESET button for at least 2 seconds (see Fig. 5). The Model 41-3A must be reset following any interruption of ac power. The following indicators are lighted at this time:

- (1) Channel A IDLE
- (2) Channel B IDLE
- (3) PROGRAM ERROR
- (4) TEST PROGRESS ON-HOOK (basic unit only).

Note: If the Model 41-3A is equipped with the Expanded Remote Control Option, its TEST PROGRESS IDLE indicator lights instead of the TEST PROGRESS ON-HOOK indicator.

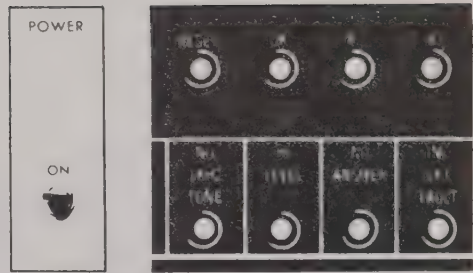


Fig. 5—Power and Reset Controls

3.06 Line Control

3.07 The line control is used to select the placement of test calls on channel A and/or B lines (see Fig. 6). Normally, the two TEST pushbuttons are engaged for testing on both channels. If all lines are idle when two-channel testing is selected, test calls are alternated between channel A and channel B. (Busy lines and empty rear-panel circuit selector jacks are bypassed.) If call completion data for only one channel is desired, engage the appropriate TEST A or B pushbutton.

Note: One or both TEST pushbuttons must be engaged to avoid a program error condition.

3.08 The TRACE pushbutton is used only for troubleshooting and is normally released. Its troubleshooting function is discussed later. The TALK and EXT pushbuttons are also normally released. Explanations of the TALK, EXT, and BRIDGE functions are provided later.

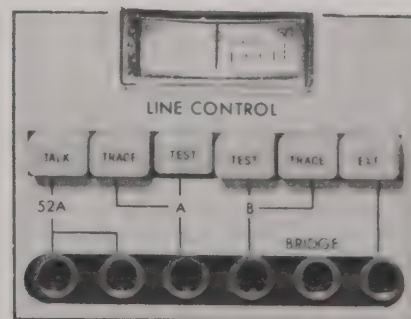


Fig. 6—Line Controls

3.09 Test Program

3.10 Test program controls determine (a) the test faults the Model 41-3A is programmed to detect, and (b) under what conditions, if any, the 41-3A halts and holds a line under test for troubleshooting. These programming controls are shown in Fig. 7.

3.11 All selected tests must be satisfied (no faults detected) before the Model 41-3A records a TEST OK result for a dialed number. Use the following selection steps to program which tests are to be made on the call origination lines.

- (1) If detection of an open C-lead fault is desired, engage the OPEN C-LEAD pushbutton.
- (2) If detection of a false tip/ring polarity reversal during dialing is desired, engage the REV DRNG-DIAL pushbutton.
- (3) If detection of a 1-kHz tone is desired, engage the 1KHZ TONE pushbutton. The 1-kHz tone source can be the 41-3A's built-in test line or another source such as a type 102 test line. After engaging the 1KHZ TONE, use the DB controls to set acceptable upper and lower level limits. The DB controls are set as follows.

(a) Set the EML control to the expected measured level (-20 to 0 dBm). If the 41-3A built-in test line is used, set the EML for 0 dBm minus the estimated loss from telephone equipment.

Note: The expected level will be as selected by the EML control for both 600 and 900 -ohm circuits.

(b) Determine an acceptable negative deviation from the EML setting, and set the LO-LIMIT control to the determined dB value.

(c) Determine an acceptable positive deviation from the EML setting, and set the HI-LIMIT control to the determined dB value.

(4) If detection of answer supervision (tip/ring polarity reversal) is desired, engage the ANS SUP pushbutton.

(5) If detection of a call completed to the unit's internal test line is desired, engage the INC CKT pushbutton. For this test, the rear panel INCOMING CIRCUIT terminals must connect to an incoming circuit as described under subject heading Telephone Line Connections.

Note: At least one or more of the 1KHZ TONE, ANS SUP, and INC CKT pushbuttons must be engaged to prevent a program error condition.

3.12 The Model 41-3A can also be programmed to halt a dialing operation and to hold a line under test for troubleshooting. Use the following selection steps to program one or more HOLD ON conditions.

- (1) Engage the REORDER button to hold a line on which a reorder tone (without a false tip/ring reversal) is detected.
- (2) Engage the BUSY button to hold a line on which a busy tone (without a false tip/ring reversal) is detected.
- (3) Engage the R OR B + ANSWER button to hold a line on which both a false tip/ring polarity reversal (answer) and either a reorder or busy tone is detected.
- (4) Engage the FAULT button to hold a line on which any fault is detected. A fault is detected when the test program is not satisfied, or when a dial tone (or a wink) signal is absent or late. A detected busy/reorder hold condition is not recorded as a fault.
- (5) The MANUAL hold button is normally released. It is engaged to manually hold a line under test.

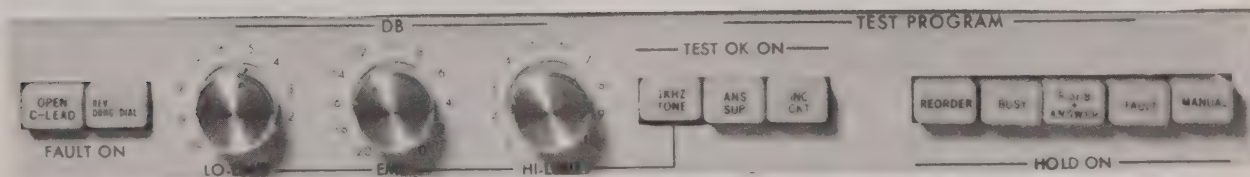


Fig. 7—Test Program Controls

3.13 System Timing & Monitor

3.14 The four system timing and monitor controls shown in Fig. 8 are used to adjust the Model 41-3A's overall timing and monitor audio volume.

3.15 The NETWORK DLY control sets the maximum time allowed to obtain a test OK after completion of dialing. The time can be set from approximately 2 to 60 seconds. If the test program is not satisfied and a busy or reorder tone is not detected within the network delay time, a fault is recorded in the appropriate category. *A typical setting for this control is 15 seconds.*

3.16 The RECYCLE PERIOD control sets the minimum on-hook period between test calls. This control permits adjustment from approximately 2 to 8 seconds. At the end of this period, the Model 41-3A finds the next idle line and dials the next test call. *A typical period control setting is 4 seconds.*

3.17 The TEST OK TIME control sets the minimum time a satisfactory test result must be present before a test OK can be recorded. This control can be set from approximately 2 to 8 seconds. *A typical setting is 5 seconds.*

3.18 The DIALING/MASTER VOLUME controls can be adjusted as desired while test calls are in progress. These controls should initially be set at midrange.

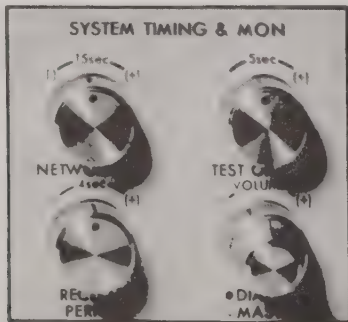


Fig. 8—System Timing & Monitor Controls

3.19 Start Dial Command

3.20 The start dial command determines the conditions which must be met before dialing can begin. As indicated in Fig. 9, the two programmable start dial conditions are DELAY and DIAL TONE.

Note: At least one of the DELAY or DIAL TONE buttons must be engaged to prevent a program error condition. Assuming previous operating instructions have been followed, a PROGRAM ERROR indication is not displayed when either DELAY or DIAL TONE is engaged.

3.21 Engaging only the DELAY button programs the Model 41-3A to begin dialing at the end of a set time interval following initial off-hook. This delay interval is set by the START AFTER control, which has a range of approximately 2 to 8 seconds. *A typical setting is 4 seconds.*

3.22 Engaging only the DIAL TONE button programs the 41-3A to begin dialing upon receipt of a valid start-dial signal. The FAULT AFTER control setting determines the maximum wait time for the start-dial signal. If a start-dial signal is not detected during this fault-after interval, the test call is aborted, a no dial tone fault is recorded, and the NO DIAL TONE indicator lights. The fault-after interval can be set between approximately 1 to 7 seconds. *A typical setting is 3 seconds.*

3.23 Either of the following is considered a valid start-dial signal.

- (1) Dial tone
- (2) A reversed tip/ring polarity (off-hook) present on the line under test for at least 128 milliseconds, followed by a return to normal polarity (on-hook) for at least 200 milliseconds.

Note: The line under test can be in either the normal or reversed state prior to seizure.

3.24 The above engaged DELAY or DIAL TONE command must also be satisfied when a WSD (wait-for-start-dial) pause is encountered during dialing. (The WSD pause is discussed later under subject heading Dialer Program.)

3.25 When both DELAY and DIAL TONE commands are engaged, the Model 41-3A is programmed to:

- (1) Begin dialing when dial tone (or wink) is received
- (2) Resume dialing after the START AFTER delay expires following a WSD pause.

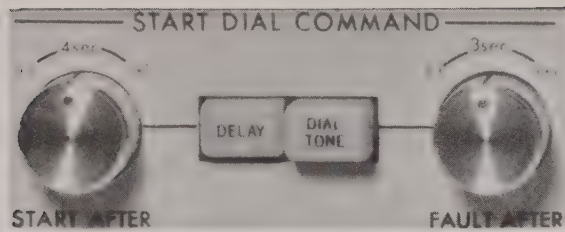


Fig. 9—Start Dial Command Controls

3.26 Dialer Program

3.27 The dialer program defines the number to be dialed, the type of dialing, and certain dialing parameters. The DIALER PROGRAM controls are shown in Fig. 10.

3.28 Place the TT/DP/MF switch in the appropriate position to select Touch-Tone®, dial pulse, or multifrequency dialing. If MF is selected, the KP and ST tones are automatically transmitted at the proper times. The KP code is always transmitted for 100 milliseconds and is followed by a tone-off period of 70 milliseconds. The ST code and MF digits are transmitted as determined by SPEED and %BRK thumbwheel settings.

3.29 Place the RESET/→/NORM switch to RESET, then to → (load); the keypad can now be used to enter the dialing number. The number to be dialed should reach a type 102 or other suitable test line. When the Model 41-3A's built-in test line is used, the dialing number is the number of the incoming circuit.

Note: The incoming circuit connections are explained under the subject heading Telephone Line Connections as part of the installation procedures.

3.30 Press the WSD key as needed to program wait-for-start-dial intervals between digits of the dialing number. When dialing through PBX-type equipment to reach a central office for example, enter a WSD between the digit (usually digit 9) used to obtain a second dial tone (or wink) and the remaining digits.

Note: The WSD interval is determined by the START DIAL COMMAND controls, explained previously under the subject heading Start Dial Command.

3.31 Press the EON key after keying all the dialing digits, and return the RESET/→/NORM switch to NORM. The dialing digits are displayed in the TEST PROGRESS readout at half brightness. (Dialed digits are displayed at full brightness.) The EON and WSD entries are not displayed.

Note: A total of 32 digits plus one EON character can be stored in the Model 41-3A's dialer. Entered WSD characters are stored as digits. Each WSD character therefore reduces the numerical digit capacity by one. Also, only the first 11 numerical digits are displayed.

3.32 The Model 41-3A can be programmed to dial CAMA-ANI calling party digits as follows.

- (1) Set RESET/→/NORM switch to RESET, then to → (load).
- (2) Key the desired test line number (called party number), then press the EON key. (The called party number is displayed at this time.)
- (3) Key the calling party number — it is not necessary to press the EON key after the calling party number. (Only the calling party number is displayed at this time.)
- (4) Set RESET/→/NORM switch to NORM.

3.33 When programmed to dial CAMA-ANI calling party digits, the Model 41-3A dials the called party number first, then waits for a tip/ring polarity reversal lasting longer than 128 milliseconds before dialing the calling party number as multifrequency digits. (The KP and ST codes are automatically sent with calling party digits at the proper time.)

3.34 The DIALER PROGRAM thumbwheel switches are set as explained in the following steps.

- (1) The two SPEED thumbwheels can be set between digit settings of 00 and 99. **Typical settings are:**
 - (a) 12 pulses per second for DP dialing
 - (b) 10 digits per second for TT or MF dialing.
- (2) The two % BREAK thumbwheels can be set between digit settings of 00 and 99. **Typical settings are:**
 - (a) 60 percent break for DP dialing
 - (b) 50 percent tone-on duty cycle for TT and MF dialing.

(3) The three IDT (interdigital time) thumbwheels are used only for DP dialing. (The IDT settings have no effect for TT and MF dialing.) The IDT thumbwheels can be set between digit settings of 000 and 999. As shown in Fig. 11 below, the IDT setting and the make time add together to equal the interdigit time. The make time is determined by the SPEED and % BREAK settings, and it must be accounted for when specifying the interdigit time via the IDT thumbwheels. A proper IDT value is calculated as follows:

- Refer to the graph of Fig. 12, and find the intersection point of the set pulsing speed and percent break values.
- Select the diagonal line nearest the intersection.
- Read the make time (in milliseconds) at either end of the diagonal line.
- Subtract the make time from the desired interdigit time, and set the IDT thumbwheels to the calculated value.

3.35 When DP dialing is used, one of several values of leak impedance or loop resistance can be selected with the LEAK/LOOP switches. It is not typical practice to use both leak impedance and loop resistance at the same time. When not used, these switches are set to the NORM position.

3.36 The LEAK (inner knob) selections are listed in Table C. The shunt networks are used internally to simulate the effects of ringing bridges, senders, etc. The last four resistive networks are primarily used when routing Stromberg-Carlson X-Y offices.

3.37 The LOOP (outer knob) selections are listed in Table D. The series networks are used to simulate the effects of various loop lengths.

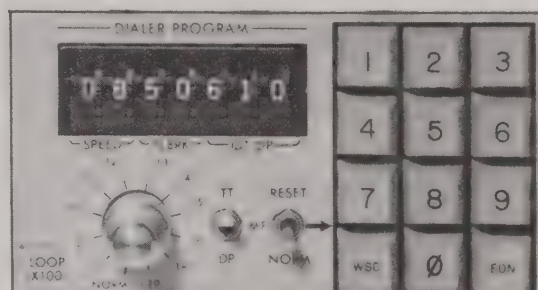


Fig. 10—Dialer Program Controls

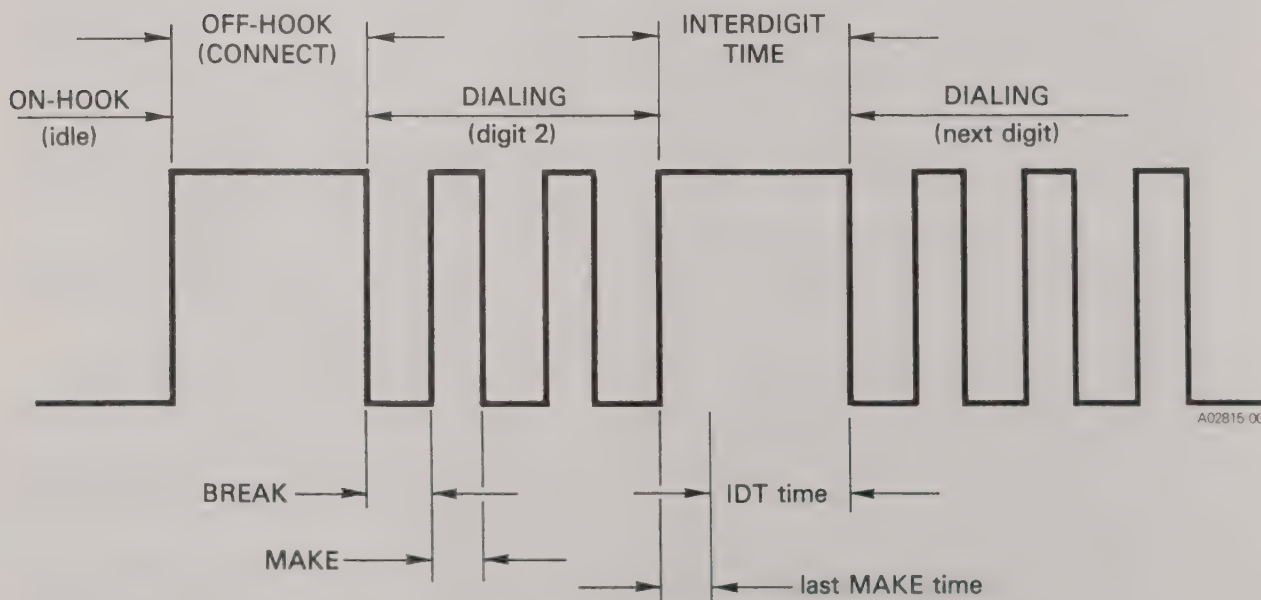
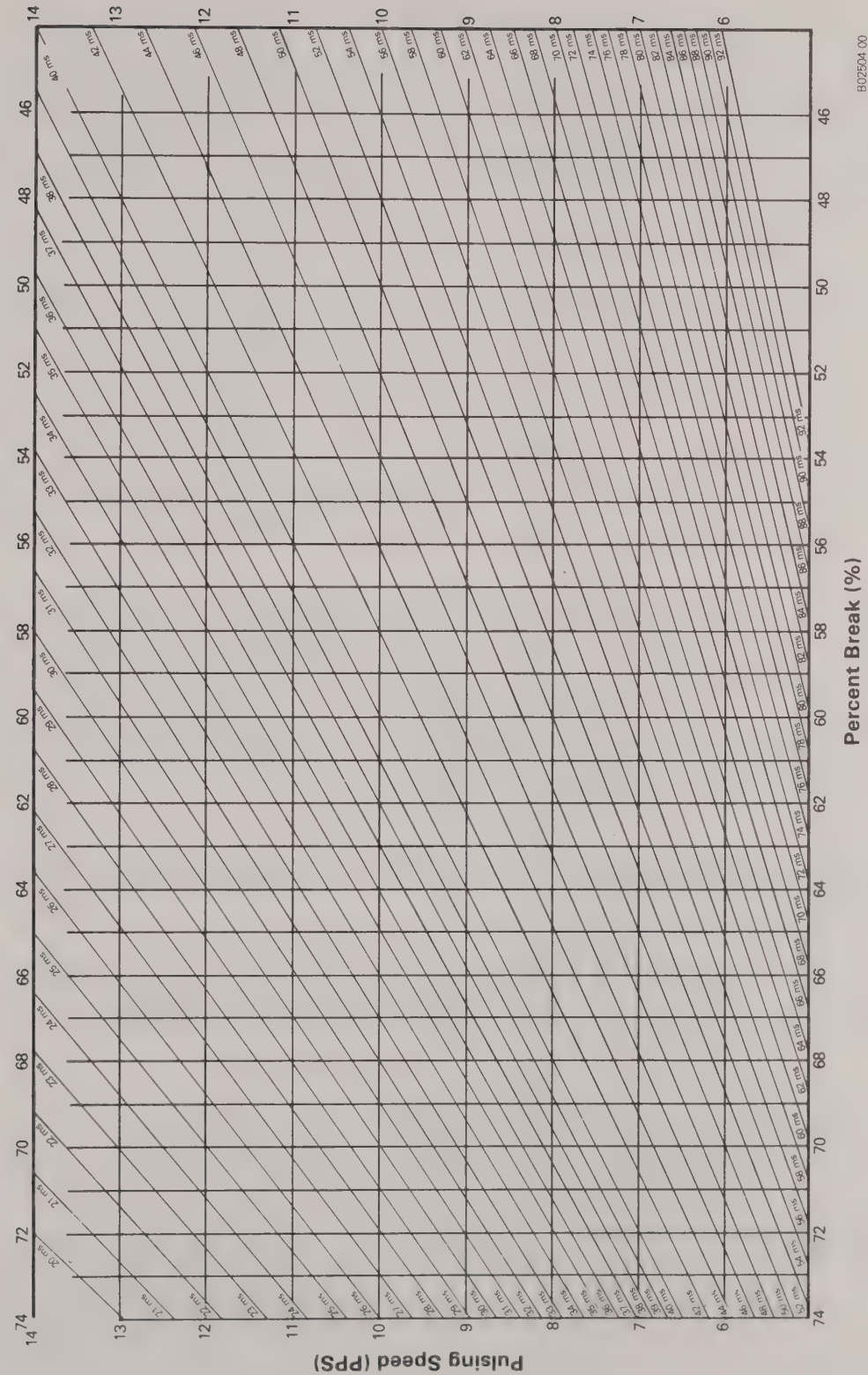


Fig. 11—IDT Interval

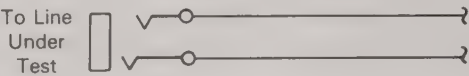
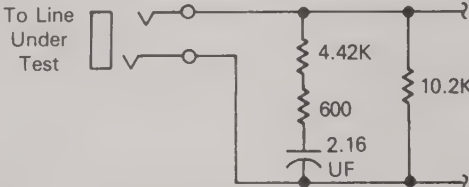
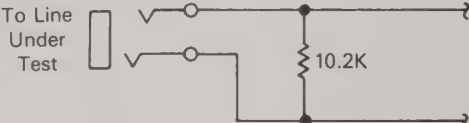
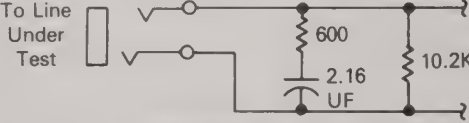
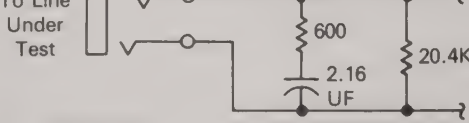
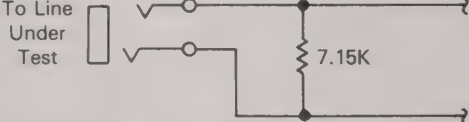
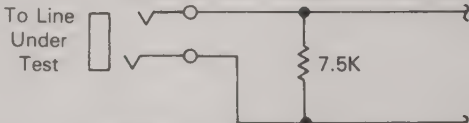
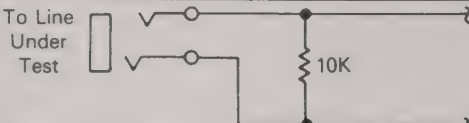
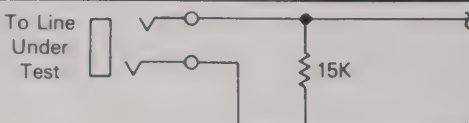


B02504 00

Fig. 12—Make Time Graph

TABLE C

LEAK IMPEDANCE NETWORKS

LEAK SWITCH SETTING	SCHEMATIC	SIMULATES	
NORM		Open circuit.	
A		A subscriber line near the central office equipped with five C4A ringing bridge extensions and a 15-kohm leak on the drop wire.	
B		A sender output without contact protection and with a 10.2-kohm leak.	
C		A circuit sender loop pulsing network with a 10.2-kohm leak across the trunk.	
D		A sender output with a leak of 20.4-kohms.	
7.15		A line with a 7.15-kohm leak.	For Stromberg- Carlson X-Y Offices
7.5		A line with a 7.5-kohm leak.	
10		A line with a 10-kohm leak.	
15		A line with a 15-kohm leak.	

802817-00

TABLE D**LOOP RESISTANCE VALUES**

LOOP SWITCH POSITION	VALUE
N	< 1 ohm
6	600 ohms
8	800 ohms
10	1 kohms
11	1.1 kohms
12	1.2 kohms
13	1.3 kohms
14	1.4 kohms
15	1.5 kohms
16	1.6 kohms
18	1.8 kohms
19	1.9 kohms

B. Testing Instructions

3.38 After the Model 41-3A analyzer is correctly programmed as described in previous paragraphs, it can be applied to a routing task. Table E below is provided as a suggested verification procedure prior to beginning a testing operation.

TABLE E**TEST VERIFICATION**

ACTION	RESULT
1. To verify installation and programming of the analyzer, place MODE switch to SINGLE CALL.	Unit goes off-hook on the selected idle channel A or B line. If the start dial program is satisfied, the unit dials the stored number. The dialing signals (DP, TT, or MF) are heard as the number is dialed. The dialed digits appear in TEST PROGRESS readout at full brightness. The TEST PROGRESS display shows which operation the unit is currently performing. If the test program is satisfied, the TEST OK indicator lights and a count is placed in the test OK category. If a test selected by one of the engaged test program pushbuttons is not satisfied, a fault is recorded in the appropriate test results category, and the appropriate indicator lights. If the unit detects busy or reorder tone, a count is recorded and the appropriate indicator lights. The unit also determines if false tip/ring polarity reversal (answer) occurs with a busy or reorder tone. After the unit determines test results, it remains off-hook and the SYSTEM HELD indicator lights. An alarm tone is heard from the unit's speaker.
2. If analyzer did not perform as expected, set MODE switch to IDLE and recheck installation and programming. Repeat step 1 until proper operation is achieved.	

TABLE E (Cont)

ACTION	RESULT
3. Adjust DIALING/MASTER VOLUME controls as desired. (The DIALING VOLUME control sets the volume only when unit is dialing.)	
4. Set MODE switch to AUTO.	Analyzer places a test call as described in step 1. After test results have been determined, the unit returns to on-hook unless held off-hook by a HOLD ON program. Note: If troubleshooting on a held line is desired, refer to paragraph 3.41. All test result indications are removed when the unit returns on-hook. The unit remains on-hook for a time determined by the RECYCLE PERIOD control. Then the unit goes off-hook to place another test call on an idle line.
5. To remove unit from a SYSTEM HELD condition, momentarily place MODE switch to IDLE, then return to AUTO.	Unit resumes testing.
6. If manually holding the line under test is desired, engage the MANUAL pushbutton.	SYSTEM HELD indicator lights. Unit remains off-hook at the end of the current test cycle.
7. Release MANUAL pushbutton to resume automatic testing if this pushbutton was engaged previously.	Unit resumes testing.
8. Release the line under test and halt all testing by setting MODE switch to IDLE.	IDLE indicator lights. Testing stops.

3.39 Test Results Readout

3.40 The TEST RESULTS readout normally displays the total number of tests performed. The counts stored for all other test result categories are

displayed in the TEST RESULTS readout when the corresponding pushbuttons are pressed. (See Fig. 13.) To reset all test result categories to zero (blank), press RESET pushbutton with MODE switch at IDLE.

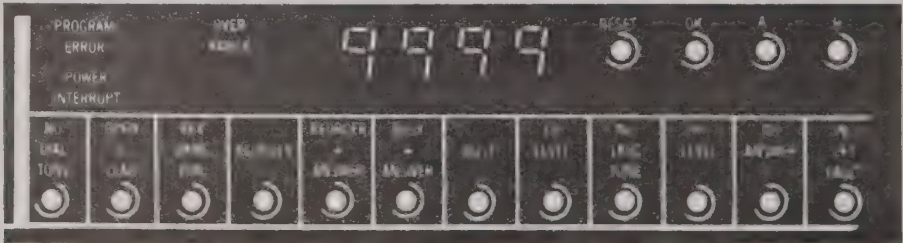


Fig. 13—Test Results Readout

3.41 Troubleshooting a Call Completion Failure

3.42 If the analyzer detects a call completion failure for which a HOLD ON pushbutton is engaged, the analyzer halts automatic operation and holds the failed line (off-hook) for troubleshooting. An alarm tone is heard at this time and the SYSTEM HELD message is displayed. If an open C-lead condition occurs on the failed line, the analyzer automatically supplies up to approximately 180 mA sleeve current in an attempt to hold switched connections for troubleshooting.

3.43 When the unit is holding a failed line, all digits of the dialing number are displayed at full brightness only if the entire number was successfully dialed. If a fault occurred during the dialing period, only digits successfully dialed are displayed at full brightness. Thus, a call completion failure detected during dialing can be pinpointed to a particular switching level by noting the relationship of half-bright to fully-bright digits on the TEST PROGRESS readout.

3.44 The analyzer holds a failed line for troubleshooting as long as necessary. A held line is released and testing resumed at any time by momentarily setting the MODE switch at IDLE, then returning it to AUTO.

3.45 The unit's trace feature can be used to troubleshoot a call completion failure. If, for example, a channel A failure is encountered and the line is held, a special holding circuit with a distinctive trace tone can be switched onto the line by engaging the TRACE A pushbutton. This action frees the primary holding circuit for use on channel B while troubleshooting continues on channel A. With TEST B engaged, testing is resumed on channel B by momentarily setting the MODE switch to IDLE and then to AUTO. (It is not necessary to release the TEST A button.) The TRACE B button can be used in the same manner to troubleshoot a channel B line while testing is resumed on channel A.

3.46 Over Range Indication

3.47 Each test result category has a count capacity of 9999. The TOTAL TESTS category reaches this count first; when this occurs, the OVER RANGE indicator lights. After any category goes over range, the count then continues in that category, moving up again from zero. To remove the OVER RANGE indication, press the RESET pushbutton with MODE switch at IDLE. This action also resets all test result categories to zero.

3.48 Power Interrupt Indication

3.49 This indicator flashes to indicate the unit's power has been momentarily removed. The off (down) to ON transition of the POWER switch also causes this indicator to flash. When the power interrupt indication occurs, the PROGRAM ERROR indicator lights and the unit is held on-hook. To remove a power interrupt indication, press the RESET pushbutton for at least two seconds with the MODE switch in the IDLE position. The dialing number must be reprogrammed after a power interrupt occurs.

3.50 Program Error Indication

3.51 This message indicates that the analyzer is incorrectly programmed and hence, cannot operate. The unit is forced on-hook until all program errors are corrected. Possible program errors include the following.

- (1) The MODE switch is not at IDLE when RESET/→/NORM switch is set to RESET or → load.
- (2) Both the DELAY and DIAL TONE pushbuttons are released.
- (3) The ANS SUP, 1KHZ TONE, and INC CKT pushbuttons are all released.
- (4) Both the TEST A and TEST B pushbuttons are released.
- (5) A power interrupt condition exists.

C. Routining Examples

3.52 The following application examples illustrate the interconnections used between the Model 41-3A and telephone equipment for basic routining tasks. A particular dial mode (DP, TT, or MF) is assumed in each example; the actual dial mode in a routining task is determined by user requirements.

3.53 Routining a SXS Central Office

3.54 The 41-3A can routine a SXS central office with up to 1600 lines without changing the installation. Fig. 14 shows the analyzer properly connected to telephone switching equipment to perform this task. As shown by Fig. 14, test calls are placed to the analyzer's built-in test line so regular office test lines can be used for other purposes.

3.55 If the central office has less than 16 line finder groups, the lines under test should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing is in progress on the other channel.

3.56 To routine a SXS central office, the analyzer can be programmed as described in the following steps.

- (1) Prepare the unit for use and make initial control settings as described in paragraph 3.02.
- (2) Set DB controls for an EML (expected measured level) of 0 dBm and low and high limits of 5 dB.
- (3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60%, and an IDT (interdigital time) of 600 milliseconds.
- (4) Set POWER switch to ON.
- (5) Press RESET pushbutton located in TEST RESULTS section of front panel for at least two seconds.
- (6) Engage the following pushbuttons:
 - (a) TEST A
 - (b) TEST B
 - (c) DIAL TONE
 - (d) OPEN C-LEAD
 - (e) 1KHZ TONE
 - (f) INC CKT
 - (g) FAULT.
- (7) Set RESET/—/NORM switch to RESET, then to load (—).
- (8) Enter the number necessary to reach the analyzer's test line with the keyset. After the number to be dialed has been entered, press the EON key.
- (9) Set RESET/—/NORM switch to NORM.

3.57 The above programming prepares the 41-3A analyzer for the following functions.

- (1) Alternate test calls between channel A and channel B.
- (2) Begin dialing after dial tone is detected.
- (3) Check for open circuit or battery on the sleeve lead of the line under test after dialing begins.
- (4) Determine if the analyzer's internal test line has been reached. When the internal test line is reached, 1-kHz tone from the test line is sent through the office switching equipment to the analyzer channel A or channel B on which the test call was placed.
- (5) Check for the presence of 1-kHz tone on the channel A or channel B line under test at a level of 0 dBm $\pm$ 5 dB. The expected level selected is 0 dBm for both 600 and 900-ohm circuits.
- (6) Halt all testing and remain off-hook on the line under test if the analyzer detects any of the faults described in the following paragraph.

3.58 The Model 41-3A detects a fault if any of the following occur.

- (1) Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook.
- (2) The sleeve lead of the line under test is open circuit or more negative than -11 V, after dialing begins. The analyzer automatically supplies up to 180 mA sleeve current in an attempt to hold switched connections for troubleshooting.
- (3) The internal test line is not reached within approximately 15 seconds (NETWORK delay) after dialing is completed. Refer to paragraph 2.15 for conditions necessary for call completion to the test line.
- (4) A 1-kHz tone is not present on the line under test at a level of 0 dBm $\pm$ 5 dB within approximately 15 seconds after dialing is completed.

3.59 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer does not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation is achieved, place MODE switch to AUTO to commence automatic testing.

3.60 If the analyzer detects a fault, an alarm is heard and a lit message lamp shows the type of fault. The analyzer remains off-hook on the line under test and all testing stops. When this occurs, pressing the appropriate TRACE pushbutton applies a tracing tone on the line under test for troubleshooting purposes. While troubleshooting with the trace tone on one channel, testing can be resumed on the other channel by momentarily placing the MODE switch to IDLE, then returning to AUTO.

3.61 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed.

Note: All test result indicators are defined in Part D.

3.62 Set the MODE switch to IDLE to release the line under test and halt all testing.

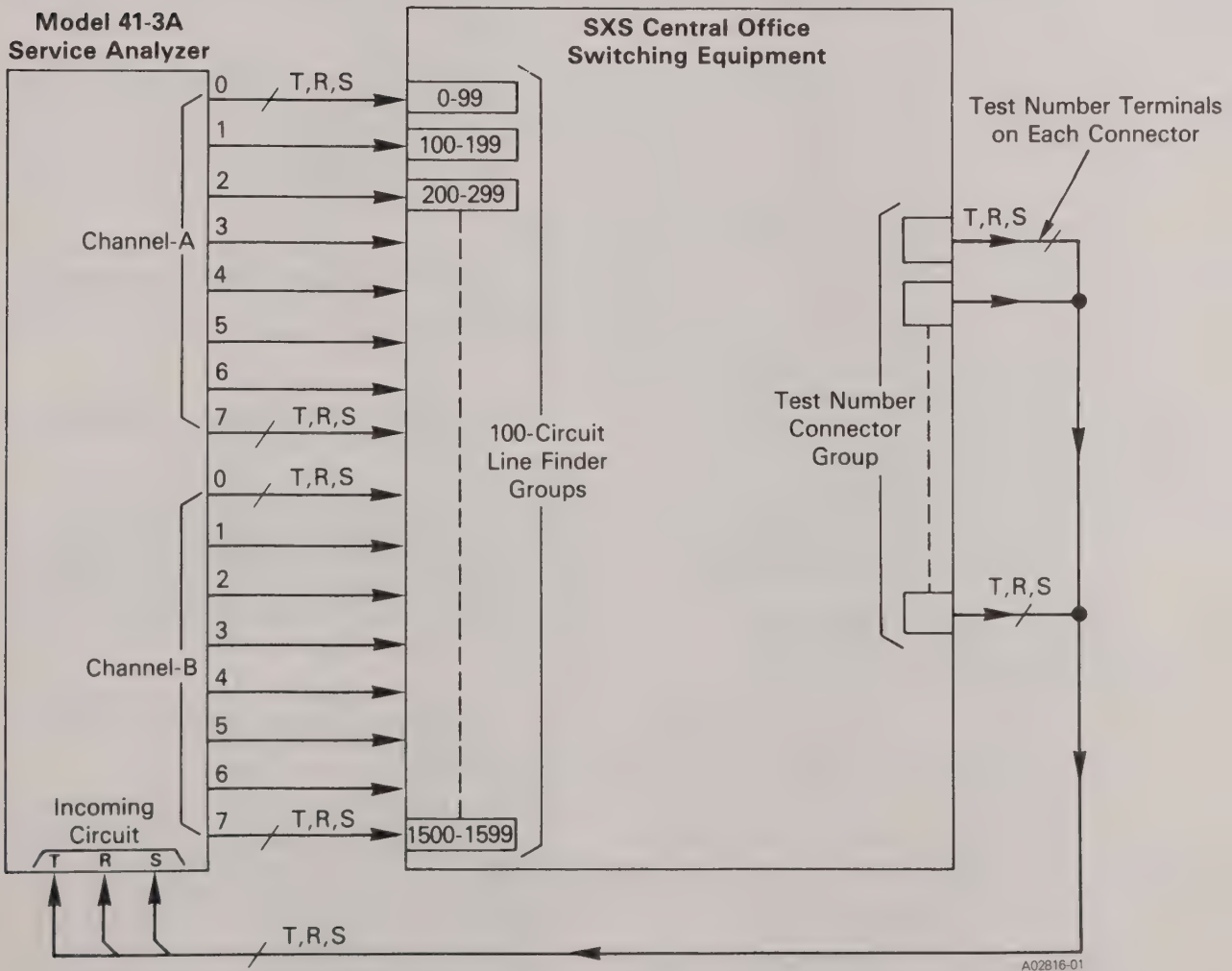


Fig. 14—Routing a 1600-Line SXS Office

3.63 Routining Outgoing Trunks

3.64 This application describes routining outgoing loop trunks requiring dial pulse dialing, an operation that can be performed by any Model 41-3A. An application involving the multifrequency dialing is given later in this section. The Model 41-3A cannot be used on 4-wire trunks.

3.65 The analyzer can be connected to outgoing trunks as shown in Fig. 15. If less than 16 trunks are to be tested, they should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing progresses on the other channel.

3.66 To routine outgoing trunks, the analyzer can be programmed as described in the following steps.

- (1) Prepare the unit for use and make initial control settings as described in paragraph 3.02.
- (2) Set the DB controls for an EML (expected measured level) of 0 dBm minus the estimated loss in the outgoing trunks, and low and high limits of 5 dB.
- (3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60%, and IDT (interdigital time) of 600 milliseconds.
- (4) Set POWER switch to ON.
- (5) Press RESET pushbutton located in TEST RESULTS section of the front panel.
- (6) Engage the following pushbuttons:
 - (a) TEST A
 - (b) TEST B
 - (c) DELAY
 - (d) ANS SUP
 - (e) 1KHZ TONE.
- (7) Set RESET/→/NORM switch to RESET, then to load (→).
- (8) Use the keyset to enter the number necessary to reach a source of 1-kHz tone (such as a type 102 test line) located at the far end of outgoing trunks. After the number to be dialed has been entered press the EON key.
- (9) Set RESET/→/NORM switch to NORM.

3.67 The above programming prepares the analyzer to do the following.

- (1) Alternately check channel A and channel B for trunks that are idle (sleeve lead open circuit or more negative than -11 V). The analyzer goes off-hook when an idle trunk is selected.
- (2) Begin dialing approximately 4 seconds (START AFTER delay) after going off-hook.
- (3) Check for the presence of 1-kHz tone on the trunk under test at a level with the range determined by settings of the DB controls. The expected level is as selected by the EML control for both 600 and 900-ohm circuits.
- (4) Check for presence of answer supervision (tip/ring reversal) after dialing is completed.
- (5) Continue testing after the analyzer detects a fault.

3.68 The Model 41-3A is prepared to detect a fault if either of the following occur:

- (1) A 1-kHz tone is not present on the trunk under test within approximately 15 seconds (NETWORK delay) after dialing is completed. The 1-kHz tone must also be detected at a level that is within the range determined by DB control settings to avoid a fault.
- (2) Answer supervision is not detected within approximately 15 seconds after dialing is completed.

3.69 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer does not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation is achieved, place MODE switch to AUTO to commence automatic testing.

3.70 As each test call is placed, the TEST RESULTS readout increments to indicate the total of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons

Note: All test result indicators are defined under Part D.

3.71 To release the line under test and halt all testing at any time, set MODE switch to IDLE.

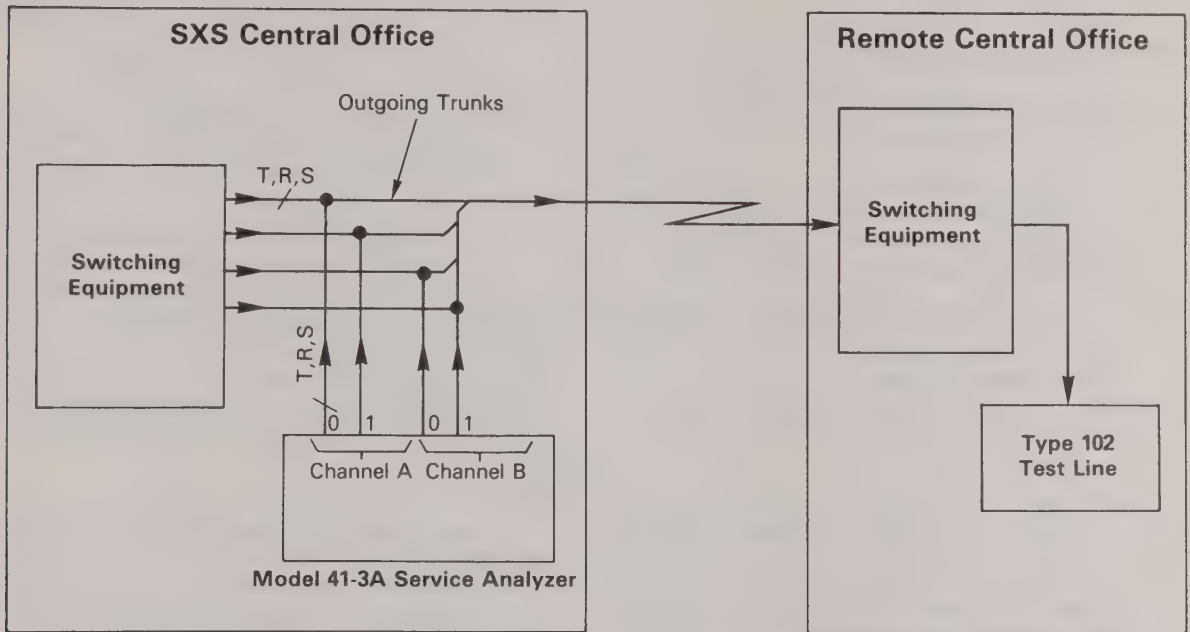


Fig. 15—Routing Outgoing Trunks

3.72 Routing Incoming Trunks

3.73 This application describes routing incoming loop trunks requiring multifrequency dialing. Fig. 16 shows the analyzer properly connected to incoming trunks. If less than 16 trunks are tested, they should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing progresses on the other channel.

3.74 To routine incoming trunks, the analyzer can be programmed as described in the following steps.

- (1) Prepare the unit for use and make initial control settings as described in paragraph 3.02.
- (2) Set DB controls for an EML (expected measured level) of 0 dBm and low and high limits of 5 dB.

- (3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 10 digits per second, and a percent tone (% BRK digits) of 50%. The IDT thumbwheels are not used in this application.
- (4) Set TT/DP/MF switch to MF.
- (5) Set POWER switch to ON.
- (6) Press RESET pushbutton located in TEST RESULTS section of front panel for at least one second.
- (7) Engage the following pushbuttons:
 - (a) TEST A
 - (b) TEST B
 - (c) DIAL TONE (programs detection of wink)
 - (d) ANS SUP
 - (e) 1KHZ TONE
 - (f) INC CKT
 - (g) FAULT.

- (8) Set RESET/→/NORM switch to RESET, then to load (→).
- (9) Use analyzer's keyset to enter the number necessary to reach the analyzer's test line. After the number to be dialed has been entered, press the EON key.
- (10) Set RESET/→/NORM switch to NORM.

3.75 The above programming prepares the analyzer to do the following.

- (1) Alternately check channel A and channel B for trunks that are idle (sleeve lead open circuit or more negative than -11 V.) The analyzer goes off-hook when an idle trunk is selected.
- (2) Begin multifrequency dialing after a wink or similar start dial signal (off-hook to on-hook tip/ring reversal) is detected.
- (3) Transmit the KP and ST signals at the proper times.
- (4) Check for presence of answer supervision (tip/ring reversal) after dialing is completed.
- (5) Determine if the analyzer's internal test line has been reached. When the internal test line is reached, 1-kHz tone from the test line is sent through the office switching equipment to the analyzer channel A or channel B line on which the test call was placed.
- (6) Check for the presence of 1-kHz tone on the trunk under test at a level of 0 dBm $\pm$ 5 dB. The expected level selected is 0 dBm for both 600 and 900-ohm circuits.
- (7) Halt all testing and remain off-hook on the trunk under test if the analyzer detects any of the faults described in the following paragraph.

3.76 The Model 41-3A is prepared to detect a fault if any of the following occur.

- (1) A wink or similar start dial signal is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook.

- (2) Answer supervision is not detected within approximately 15 seconds (NETWORK delay) after dialing is completed.
- (3) The internal test line is not reached within approximately 15 seconds after dialing is completed. Refer to paragraph 2.15 for conditions necessary for call completion to the test line.
- (4) A 1-kHz tone is not present on the trunk under test at a level of 0 dBm $\pm$ 5 dB within approximately 15 seconds after dialing is completed.

3.77 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer does not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation is achieved, place MODE switch to AUTO to commence automatic testing.

3.78 If the analyzer detects a fault, an alarm is heard and a lit message lamp shows the type of fault that occurred. The analyzer remains off-hook on the line under test and all testing stops. When this occurs, pressing the appropriate TRACE pushbutton applies a tracing tone on the line under test for troubleshooting purposes. While troubleshooting with the trace tone on one channel, testing can be resumed on the other channel by momentarily placing the MODE switch to IDLE, then returning to AUTO.

3.79 As each test call is placed, the TEST RESULTS readout increments to indicate the total number of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed.

Note: All test result indicators are defined under Part D.

3.80 Set MODE switch to IDLE to release the line under test and halt all testing at any time.

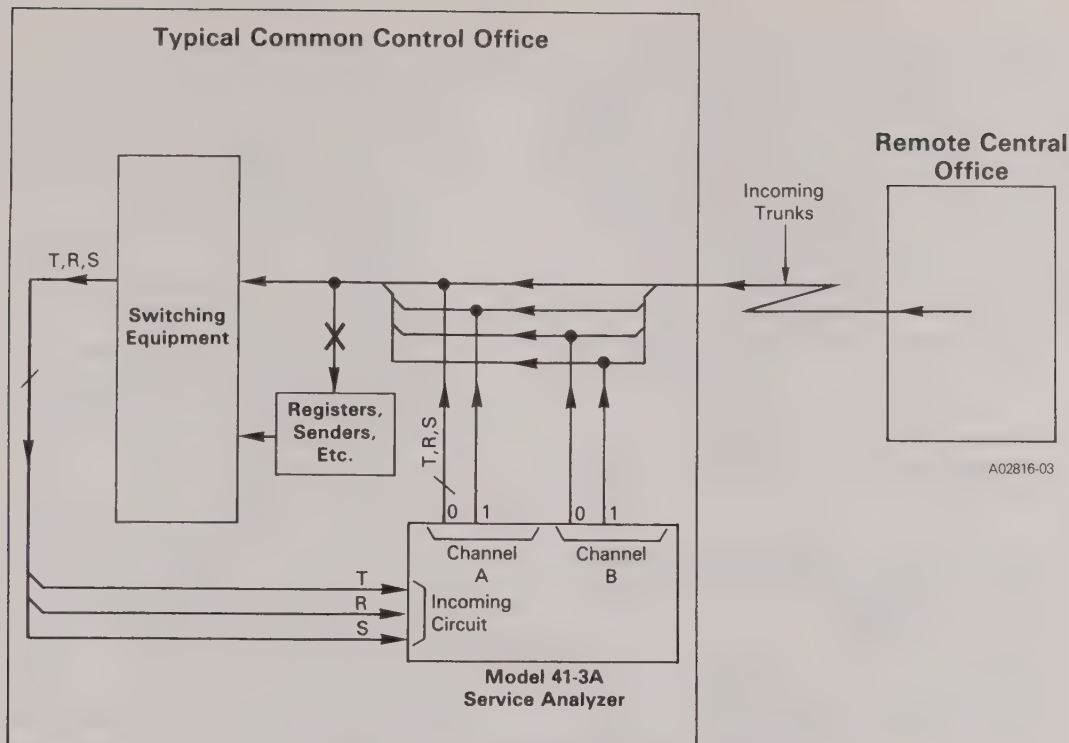


Fig. 16—Routing Incoming Trunks

3.81 Routing PBX Trunks

3.82 The Model 41-3A can routine PBX trunks via switching equipment in a private branch exchange. Figure 17 shows the analyzer properly connected to PBX equipment to perform this task. The PBX in this example is assumed to be a SXS-type or similar type requiring dial pulsing.

3.83 If the PBX has less than 16 line finder groups, the lines under test should be evenly divided between channel A and channel B. This allows troubleshooting on a held line on one channel while testing is in progress on the other channel.

3.84 To routine PBX trunks, the analyzer can be programmed as described in the following steps.

- (1) Prepare the unit for use and make initial control settings as described in paragraph 3.02.
- (2) Set DB controls for an EML (expected measured level) of 0 dBm minus the estimated loss in the PBX trunks under test, and low and high limits of 5 dB.
- (3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 12 pps, percent break of 60%, and an IDT (interdigital time) of 600 milliseconds.
- (4) Set POWER switch to ON.
- (5) Press RESET pushbutton located in TEST RESULTS section of front panel for at least one second.
- (6) Engage the following pushbuttons:
 - (a) TEST A
 - (b) TEST B
 - (c) DIAL TONE
 - (d) REV DRNG-DIAL
 - (e) 1KHZ TONE.
- (7) Set RESET/—/NORM switch to RESET, then to load (—).

(8) Use the keyset to enter the digit required by the PBX switching equipment to obtain the second dial tone (usually the digit 9). Press the WSD key, then enter the number necessary to reach a source of 1-kHz tone (such as a type 102 test line) located in the serving central office. After the number to be dialed has been entered press the EON key.

(9) Set RESET/--/NORM switch to NORM.

3.85 The above programming prepares the analyzer to do the following.

- (1) Alternate test calls between channel A and channel B.
- (2) Dial the first digit after dial tone is detected, then wait for an additional dial tone before resuming the dialing.
- (3) Check for a false tip/ring polarity reversal during the dialing process. This condition discloses reversed wipers in SXS switch trains.
- (4) Check for the presence of 1-kHz tone on the PBX trunk under test at a level within the range determined by the settings of the DB controls. The expected level is as selected by the EML control for both 600 and 900-ohm circuits.
- (5) Continue testing after the analyzer detects a fault.

3.86 The Model 41-3A is prepared to detect a fault if any of the following occur.

- (1) Dial tone is not detected within approximately 3 seconds (FAULT AFTER delay) after going off-hook or within approximately 3 seconds after the first digit is dialed.
- (2) A false tip/ring reversal is detected during dialing.
- (3) A 1-kHz tone is not present on the PBX trunk under test within approximately 15 seconds (NETWORK delay) after dialing is completed. The 1-kHz tone must also be detected at a level that is within the range determined by DB control settings to avoid a fault.

3.87 To verify installation and programming, place a single test call by placing the MODE switch to SINGLE CALL. Adjust DIALING/MASTER VOLUME control as desired. If the analyzer does not perform as expected, return the MODE switch to IDLE and recheck installation and programming. After proper operation is achieved, place MODE switch to AUTO to commence automatic testing.

3.88 As each test call is placed, the TEST RESULTS readout increments to indicate the total of all calls attempted. The counts stored for other test result categories are displayed in the TEST RESULTS readout when the appropriate pushbuttons are pressed.

Note: All test result indicators are defined under Part D.

3.89 To release the line under test and halt all testing at any time, set MODE switch to IDLE.

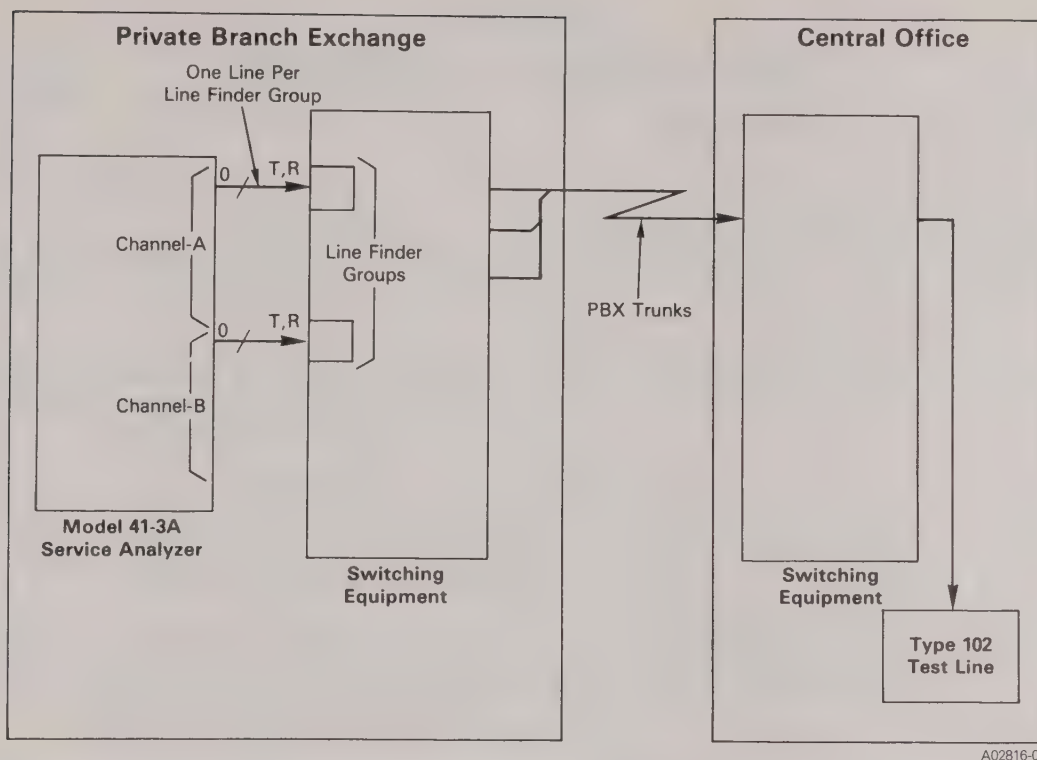


Fig. 17—Routing PBX Trunks

D. Controls and Indicators

3.90 The functions of all front panel and rear panel controls, indicators, and connectors are described in Table F. The front panel controls, indicators, and connectors are identified in Fig. 18. Figure 19 identifies rear panel controls and connectors.

TABLE F
CONTROLS, INDICATORS, AND CONNECTORS

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
POWER/LINE CONTROL GROUP		
J12/J13	52A	Allows use of a 52A headset for voice communication on selected line (if TALK pushbutton is engaged).
J14	A	For convenience, allows front panel connection of a single originating line (T/R or T/R/S) to the unit's channel A. The rear panel jack field is automatically disconnected when the A jack is used.
J15	B	For convenience, allows front panel connection of a single originating line (T/R or T/R/S) to the unit's channel B. The rear panel jack field is automatically disconnected when the B jack is used.
J16	BRIDGE	Allows T/R/S bridging connections to the selected call originating line. The line's internal connections to detection, holding and dialing circuits are not broken when the BRIDGE jack is used. <i>Note:</i> Making level measurements (or similar tests) with external equipment via the BRIDGE Jack is not recommended since the analyzer's 735-ohm termination will affect the results. The EXT jack can be used for this purpose as described in part E. EXT Jack Connection to a Held Line.
J17	EXT	Allows T/R/S terminating connections to the selected call originating line (only when EXT pushbutton is engaged). Engaged EXT pushbutton S7 breaks the line's internal connections to detection, holding and dialing circuits. The EXT pushbutton is a break-before-make type. To use the EXT jack with external test equipment without releasing the line under test, refer to part E. EXT Jack Connection to a Held Line.
M1	LINE CONTROL	Indicates dc voltage of normal or reverse polarity present on the selected call originating line.
DIALER GROUP		
S41	TT/DP/MF	Selects Touch-Tone® dialing when placed in the TT position. Selects dial pulsing when placed in the DP position. The MF position selects multifrequency dialing.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
DIALER GROUP (Cont)		
S42	RESET/—/NORM	When at RESET, blanks TEST PROGRESS readout U3-U13 except when unit is off-hook. The — (load) position enables entering of a number to be dialed via the keyset. Both the RESET and — (load) positions result in a program error unless MODE switch is at IDLE. The NORM position allows the MODE switch to be moved from IDLE without producing a program error.
S43	LEAK/LOOP	Sets leak impedance and loop resistance for dial pulsing. The LEAK (inner) control selects the leak impedance to be shunted across the line under test during dial pulsing. The LOOP (outer) control selects a loop resistance to be placed in series with the line under test during dial pulsing. Tables C and D list the values of leak impedance and loop resistance that can be selected with the LEAK/LOOP control. Note: It is not typical practice to use both leak impedance and loop resistance at the same time.
S44	DIALER PROGRAM	The SPEED thumbwheels set (from 1 to 99) the number of pulses per second for dial pulsing, or the number of digits per second for Touch-Tone® or multifrequency dialing. The % BRK thumbwheels set (from 1 to 99) the percent break for dial pulsing or the duty cycle (tone-on period) for Touch-Tone® or multifrequency dialing. The IDT thumbwheels set the interdigital time from 1 to 999 milliseconds for dial pulsing only.
S45	Keyset	Allows entry of a number to be dialed, but only when RESET/—/NORM switch is at — (load). The WSD (wait-for-start-dial) key may be used to program waits for additional dial tone (or optional wink) or start dial delay between any digits of the number to be dialed. The EON (end-of-number) key must be pressed after entering all digits of the number to be dialed.
S1	POWER	ON position applies ac power to the unit.
S2	TALK	When engaged, allows a 52A headset to be used for voice communication on the selected call originating line. The 52A headset connects to the 52A jacks. Engaged TALK switch S2 disables the monitor amplifier.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
DIALER GROUP (Cont)		
S3	TRACE A	When engaged, places a trace tone on a selected channel A line and holds the line off-hook. Engaged TRACE A pushbutton S3 disables operation of the channel A line selector and lights the TRACE A indicator. Engaged TRACE A pushbutton S3 does not inhibit tests on channel B.
S4	TEST A	When engaged, programs the unit to perform tests on channel A.
S5	TEST B	When engaged, programs the unit to perform tests on channel B.
		<i>Note:</i> If both TEST pushbuttons are engaged and all lines are idle, test calls will alternate between channel A and channel B. (Busy lines and empty rear panel circuit selector jacks are automatically bypassed.) Also, at least one TEST pushbutton must be engaged to avoid a program error condition.
S6	TRACE B	When engaged, places a trace tone on a selected channel B line and holds the line off-hook. Engaged TRACE B pushbutton S6 disables operation of the channel B line selector and lights the TRACE B indicator. Engaged TRACE B pushbutton S6 does not inhibit tests on channel A.
S7	EXT	When engaged, connects the EXT jack to the selected call originating line. Engaged EXT pushbutton S7 breaks the line's internal connections to detection/dialing/holding circuits, and presents the EXT jack to the line in a terminating configuration. Switching is break-before-make type.
SYSTEM TIMING/MODE GROUP		
R3	NETWORK DLY	Sets the maximum time allowed to obtain a test OK indication from approximately 2 to 60 seconds after completion of dialing. Faults are recorded in the appropriate test categories if the test program is not satisfied and a busy or reorder tone is not detected during this time interval. This control is typically set for 15 seconds.
R4	TEST OK TIME	Sets the minimum time duration that a satisfactory test result must be present before a test OK is recorded. Can be set from approximately 2 to 8 seconds. This control is typically set for 5 seconds.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
SYSTEM TIMING/MODE GROUP (Cont)		
R5	RECYCLE PERIOD	Sets the minimum time period the unit will be on-hook between test calls. RECYCLE PERIOD can be set for 2 to 8 seconds and is typically set for 4 seconds.
R6	DIALING/MASTER VOLUME	MASTER (outer) control sets monitor output volume at all times except when unit is dialing, or on-hook, or when a 52A headset is in use. DIALING (inner) control sets monitor output volume when unit is dialing. Monitor output is disabled when a 52A headset is in use or when unit is on-hook.
S40	MODE	IDLE position places the unit on-hook and lights the IDLE indicator. AUTO position allows repetitive test calling as programmed, except when a system hold is encountered. SINGLE CALL position instructs the unit to remain off-hook (a system hold) after placing a single test call. To avoid a program error when MODE switch is moved from IDLE position, the RESET/→/NORM switch must be in the NORM position.
START DIAL GROUP		
R1	START AFTER	Sets the delay time before dialing is begun. The delay setting is typically 4 seconds, and can be varied from approximately 2 to 8 seconds.
R2	FAULT AFTER	Sets the maximum time allowed for detection of dial tone or a wink-type start dial signal prior to dialing. If a valid start dial signal is not detected during this fault-after period, a no dial tone fault is recorded and the NO DIAL TONE indicator lights. The fault-after setting is typically 3 seconds, and can be varied from approximately 1 to 7 seconds.
S9	DELAY	When engaged, programs the unit to wait for the START AFTER control delay to expire before dialing.
S10	DIAL TONE	When engaged, programs the analyzer to wait for a start dial signal (dial tone or wink) before dialing. The maximum wait time is determined by the FAULT AFTER setting. If a valid start dial signal is not detected during the fault-after period, a no dial tone fault is recorded and the NO DIAL TONE indicator lights.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
START DIAL GROUP (Cont)		
S10 (Cont)	DIAL TONE (Cont)	Note: Both the DELAY and DIAL TONE push-buttons can be engaged when desired. This program conditions the unit to: (a) begin dialing when dial tone (or wink) is received after initial off-hook, and if WSD commands are entered into the dialer, to (b) resume dialing after the START AFTER delay expires. (Detecting neither dial tone nor wink within time allowed after initial off-hook produces a no dial tone fault.) Also, at least one of the START DIAL COMMAND pushbuttons must be engaged to avoid a program error.
TEST PROGRAM GROUP		
S11	OPEN C-LEAD	When engaged, programs the unit to record an open C-lead fault and light the OPEN "C" LEAD indicator if an open C-lead is detected.
S12	REV DRNG-DIAL	When engaged, programs the unit to record as a fault any tip/ring polarity reversal which occurs during dialing. The REV DRNG DIAL indicator lights if the unit detects this condition.
S13	LO-LIMIT	Sets the minimum acceptable level of a detected 1-kHz tone with respect to programmed EML (S14). If the level of a detected 1-kHz tone is less than the EML setting by an amount greater than the LO-LIMIT setting (in dB), a low level fault is recorded and the LO-LEVEL indicator lights. The 1KHZ TONE pushbutton must be engaged to enable this function.
S14	EML	Sets the expected measured level (in - dBm) of a 1-kHz tone to be detected. If a detected 1-kHz tone varies from the EML setting by an amount outside upper and lower limits (set by LO-LIMIT S13 and HI-LIMIT S15) a fault is recorded in the appropriate category and the appropriate indicator lights. If no 1-kHz tone above -31 dBm is detected during NETWORK DLY (R3) time period following dialing, then the NO 1KHZ TONE message lights and the fault is recorded. The 1KHZ TONE pushbutton must be engaged to enable this function. Note: The expected level will be as selected by the EML control for both 600 and 900-ohm circuits.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRAM GROUP (Cont)		
S15	HI-LIMIT	Sets the maximum acceptable level of a detected 1-kHz tone with respect to programmed EML (S14). If a detected 1-kHz tone exceeds the EML setting by an amount greater than the HI-LIMIT setting (in dB), a high level fault is recorded and the HI LEVEL indicator lights. The 1KHZ TONE pushbutton must be engaged to enable this function.
S16	1KHZ TONE	When engaged, programs the unit to record a no 1-kHz tone fault and light NO 1KHZ TONE indicator if the unit fails to detect a 1-kHz tone within the NETWORK DLY (R3) time period after dialing. The level of a 1-kHz tone must be greater than -31 dBm (from either 600 or 900-ohms) to be detected. The unit also determines if the 1-kHz tone level varies from the EML control S14 setting by an amount outside upper and lower limits set by LO-LIMIT control S13 and HI-LIMIT control S15. If either limit is exceeded, an appropriate fault is recorded and the corresponding indicator lights.
S17	ANS SUP	When engaged, programs the unit to record a no answer fault and to light the NO ANSWER indicator if tip/ring polarity reversal (answer) did not occur within the NETWORK DLY (R3) time period after dialing.
S18	INC CKT	When engaged, programs the unit to receive a test call via its internal test line. If the internal test line fails to detect a call within the NETWORK DLY (R3) time period after dialing, an incoming circuit fault is recorded and the INC CKT FAULT indicator lights. Note: At least one of the following switches must be engaged to avoid a program error: 1KHZ TONE S16, ANS SUP S17, and INC CKT S18.
S19	HOLD ON REORDER	When engaged, will cause unit to stop automatic recycling and remain off-hook if reorder tone is detected and false tip/ring polarity reversal (answer) is not detected. Both REORDER and SYSTEM HELD indicators light when this condition occurs.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRAM GROUP (Cont)		
S20	HOLD ON BUSY	When engaged, will cause unit to stop automatic recycling and remain off-hook if busy tone is detected and false tip/ring polarity reversal (answer) is not detected. Both BUSY and SYSTEM HELD indicators light when this condition occurs.
S21	HOLD ON R OR B + ANSWER	When engaged, will cause unit to stop automatic recycling and remain off-hook if false tip/ring polarity reversal (answer) is detected and either busy or reorder tone is also detected. SYSTEM HELD indicator and either REORDER + ANSWER indicator or BUSY + ANSWER indicator will light when this condition occurs.
S22	HOLD ON FAULT	When engaged, will cause the unit to stop automatic recycling and remain off-hook if any fault (not busy or reorder tone) is detected. The SYSTEM HELD indicator and the appropriate fault indicator will light when this condition occurs.
S23	HOLD ON MANUAL	When engaged, will cause the unit to stop automatic recycling and remain off-hook after completing the current test. The SYSTEM HELD indicator lights when this pushbutton is engaged. Also, the unit's alarm tone is disabled if a HOLD ON MANUAL is selected.
LINE DISPOSITION GROUP		
CR64, CR104	TEST A	Lights to indicate unit has gone off-hook after selecting an idle channel A line.
CR66, CR105	TEST B	Lights to indicate unit has gone off-hook after selecting an idle channel B line.
CR67, CR106	IDLE A	When lit indicates the selected channel A line is idle. (Sleeve lead open circuit or more negative than -11 V.)
CR68, CR107	IDLE B	When lit indicates the selected channel B line is idle. (Sleeve lead open circuit or more negative than -11 V.)
CR69, 70	TRACE A	Lights when the TRACE A pushbutton is pressed. Indicates a tracing signal is present on the selected channel A line.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
LINE DISPOSITION GROUP (Cont)		
CR71, 72	TRACE B	Lights when the TRACE B pushbutton is pressed. Indicates a tracing tone is present on the selected channel B line.
CR73, CR108	BUSY A	When lit indicates the selected channel A line is busy. (Sleeve lead at ground potential or more positive than -7 V.)
CR74, CR109	BUSY B	When lit indicates the selected channel B line is busy. (Sleeve lead at ground potential or more positive than -7 V.)
U1	CHAN A	Indicates the number of the selected channel A line.
U2	CHAN B	Indicates the number of the selected channel B line.
TEST PROGRESS GROUP		
CR33-38	INTER-DIGITAL PERIOD	Lights during time interval between dialing digits only when unit is dial pulsing.
CR39, CR60	IDLE	Lights to indicate unit is on-hook when the MODE switch is in the IDLE position.
CR40, 41	ON HOOK	Lights to indicate unit is on-hook when the MODE switch is in the AUTO or SINGLE CALL position.
CR42	TTY	Not used in basic Model 41-3A unit. Provided for use in conjunction with the expanded remote control option.
CR43-48	WAITING FOR START DIAL	When lit indicates: 1. Unit is waiting for a programmed delay to expire before dialing if the DELAY pushbutton is depressed. 2. Unit is waiting for dial tone (or wink-type start dial signal) before dialing if the DIAL TONE pushbutton is depressed. 3. If both DELAY and DIAL TONE are engaged, this message is displayed after initial off-hook to indicate unit is waiting for 2 above before dialing. If WSD command(s) are encountered during the dialing process, this message is displayed again to indicate unit is waiting for 1 above before resuming the dialing.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST PROGRESS GROUP (Cont)		
CR49, 50	DIALING	When lit indicates unit is sending dialing signaling (either Touch-Tone® , dial pulse, or multifrequency).
CR51-59, 63, 65	DIALING COMPLETED WAITING FOR TEST RESULTS	Lights when dialing is completed. Remains lit until unit determines results of test program.
CR61-62, CR103	TEST OK	Lights to indicate that a test call encountered none of the faults unit is programmed to detect. Remains lit until current test cycle is completed and unit returns to on-hook.
CR75-77, CR110	SYSTEM HELD	Lights if, for any reason, unit is not automatically recycling.
U3-13	TEST PROGRESS	Displays digits of the number to be dialed. Digits are displayed at half brightness when entered via the keyset. Each digit is brought up to full brightness when dialed out by the unit.
TEST RESULTS GROUP		
CR78-80, CR111	OVER RANGE	Lights when total tests category exceeds a count of 9999. To remove the over-range indication, the RESET pushbutton is pressed with MODE switch in IDLE position. This action also resets all test result categories to zero.
CR81-85	POWER INTERRUPT	Flashes to indicate unit's power has been momentarily removed. The off (down) to ON transition of the POWER switch also causes this indicator to flash. When the power interruption indication occurs, the PROGRAM ERROR indicator lights and the unit is held on-hook. To remove power interrupt indication, depress RESET pushbutton with MODE switch in IDLE position for at least 2 seconds. The dialing number must be reprogrammed after a power interrupt occurs.
CR 86, 87, 89, 90, CR112	PROGRAM ERROR	Lights to indicate incorrect operation of the unit. A program error occurs when a test program is incorrect, or insufficient, or MODE switch is removed from IDLE position while RESET/→/NORM switch is in the → (load) or RESET positions. A program error indication also occurs when a power interrupt condition exists. Unit remains on-hook until program error is corrected.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST RESULTS GROUP (Cont)		
CR91	NO DIAL TONE	Lights to indicate dial tone (or wink start dial) was not returned on the selected line within programmed FAULT AFTER (R2) time period. The DIAL TONE pushbutton must be engaged to detect this condition.
CR92	OPEN "C" LEAD	When lit indicates C-lead open circuit or potential more negative than -11 volts occurred during dialing or while test results were being determined. To detect this condition, the OPEN C-LEAD pushbutton must be engaged.
CR93	REV DRNG DIAL	Lights to indicate a tip/ring polarity reversal occurred while dialing. To detect this condition, the REV DRNG DIAL pushbutton must be engaged.
CR94	REORDER	Lights when unit detects reorder tone without false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR95	REORDER + ANSWER	Lights when unit detects both reorder tone and false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR96	BUSY + ANSWER	Lights when unit detects both busy tone and false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR97	BUSY	Lights when unit detects busy tone without false tip/ring polarity reversal (answer) while waiting for dial tone or when test results are being determined.
CR98	LO LEVEL	Lights when level of a received 1-kHz tone is less than the threshold level set by combination of EML control S14 and LO-LIMIT control S13. To detect this condition the 1KHZ TONE pushbutton must be engaged.
CR99	NO 1 KHZ TONE	Lights to indicate that a 1-kHz tone having level above -31 dBm (from either 600 or 900-ohms) was not received during NETWORK DLY (R3) time period following completion of dialing. To detect this condition, the 1KHZ TONE pushbutton must be engaged.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST RESULTS GROUP (Cont)		
CR100	HI LEVEL	Lights when level of received 1-kHz tone is greater than the threshold level set by combination of EML control S14 and HI-LIMIT control S15. To detect this condition, the 1KHZ TONE pushbutton must be engaged.
CR101	NO ANSWER	Lights when unit does not receive a tip/ring polarity reversal (answer) within NETWORK DLY (R3) time period following completion of dialing. To detect this condition the ANS SUP pushbutton must be engaged.
CR102	INC CKT FAULT	Lights when unit does not receive a test call placed to its internal test line during NETWORK DLY (R3) time period following completion of dialing. To detect this condition, the INC CKT pushbutton must be engaged.
S24	RESET	When pressed, resets counts in all test result categories to zero, also removes any power interrupt and over-range indications. Reset can occur only when the MODE switch is in the IDLE position. Note: To remove the POWER INTERRUPT indication, the RESET pushbutton should be pressed for at least 2 seconds.
S25	OK	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests which resulted in a test OK.
S26	A	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests attempted on channel A.
S27	B	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tests attempted on channel B.
S28	NO DIAL TONE	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no dial tone (or no wink) faults detected.
S29	OPEN "C" LEAD	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all open C-lead faults detected.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
TEST RESULTS GROUP (Cont)		
S30	REV DRNG DIAL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all tip/ring polarity reversal during dial faults detected.
S31	REORDER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all reorder tone detections without false tip/ring polarity reversal (answer).
S32	REORDER + ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all reorder tone detections which were accompanied by false tip/ring polarity reversal (answer) detections.
S33	BUSY + ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all busy tone detections which were accompanied by false tip/ring polarity reversal (answer) detections.
S34	BUSY	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all busy tone detections without false tip/ring polarity reversal (answer).
S35	LO LEVEL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all low level faults detected.
S36	NO 1KHZ TONE	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no 1-kHz tone faults detected.
S37	HI LEVEL	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all high level faults detected.
S38	NO ANSWER	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all no answer faults detected.
S39	INC CKT FAULT	When pressed, TEST RESULTS readout U14-U17 will indicate the count of all incoming circuit faults detected.
U14-U17	TEST RESULTS	Normally displays total count of all tests attempted on both channel A and channel B. The count accumulated in any other test result category is displayed when the appropriate test result pushbutton is pressed.

TABLE F (Cont)

REFERENCE DESIGNATION	NOMENCLATURE	FUNCTION
REAR PANEL GROUP		
F1/F2	fuses	Protect analyzer against excessive input current. Use 2-ampere slow-blow fuses for 115 Vac operation. Use 1-ampere slow-blow fuses for 230 Vac operation.
J18-25	CHANNEL A 0-7	Up to eight telephone lines (T/R or T/R/S) may be connected to this jack field for test call origination via unit's channel A. Unit scans and selects lines under program control. Connections are made via 310 type jacks. Any empty jacks appear busy to the unit and are skipped by the line scanning/selection circuits.
J26-33	CHANNEL B 0-7	Up to eight telephone lines (T/R or T/R/S) may be connected to this jack field for test call origination via the unit's channel B. Unit scans and selects lines under program control. Connections are made via 310 type jacks. Any empty jacks appear busy to the unit and are skipped by the line scanning/selection circuits.
J34	POWER	Unit's input power cord connects to this jack.
S48	SELECT VOLTAGE	Configures the unit for either 115 or 230 Vac operation. The proper fuses must be used for each power source as noted on the rear panel.
TB1	INCOMING CIRCUIT	The T, R, S terminals provide tip/ring/sleeve connections to the unit's internal test line. The XA and XB terminals are not used.

3.72 Routining Incoming Trunks

3.73 This application describes routining incoming loop trunks requiring multifrequency dialing. Figure 16 shows the analyzer properly connected to incoming trunks. If less than 16 trunks are tested, they should be evenly divided between channel A and channel B. This allows troubleshooting a held line on one channel, while testing progresses on the other channel.

3.74 To routine incoming trunks, the analyzer can be programmed as described in the following steps.

- (1) Prepare the unit for use and make initial control settings as described in paragraph 3.02.
- (2) Set DB controls for an EML (expected measured level) of 0 dBm and low and high limits of 5 dB.
- (3) Set the DIALER PROGRAM thumbwheel switch for a dialing speed of 10 digits per second, and a percent tone (% BRK digits) of 50%. The IDT thumbwheels are not used in this application.
- (4) Set TT/DP/MF switch to MF.

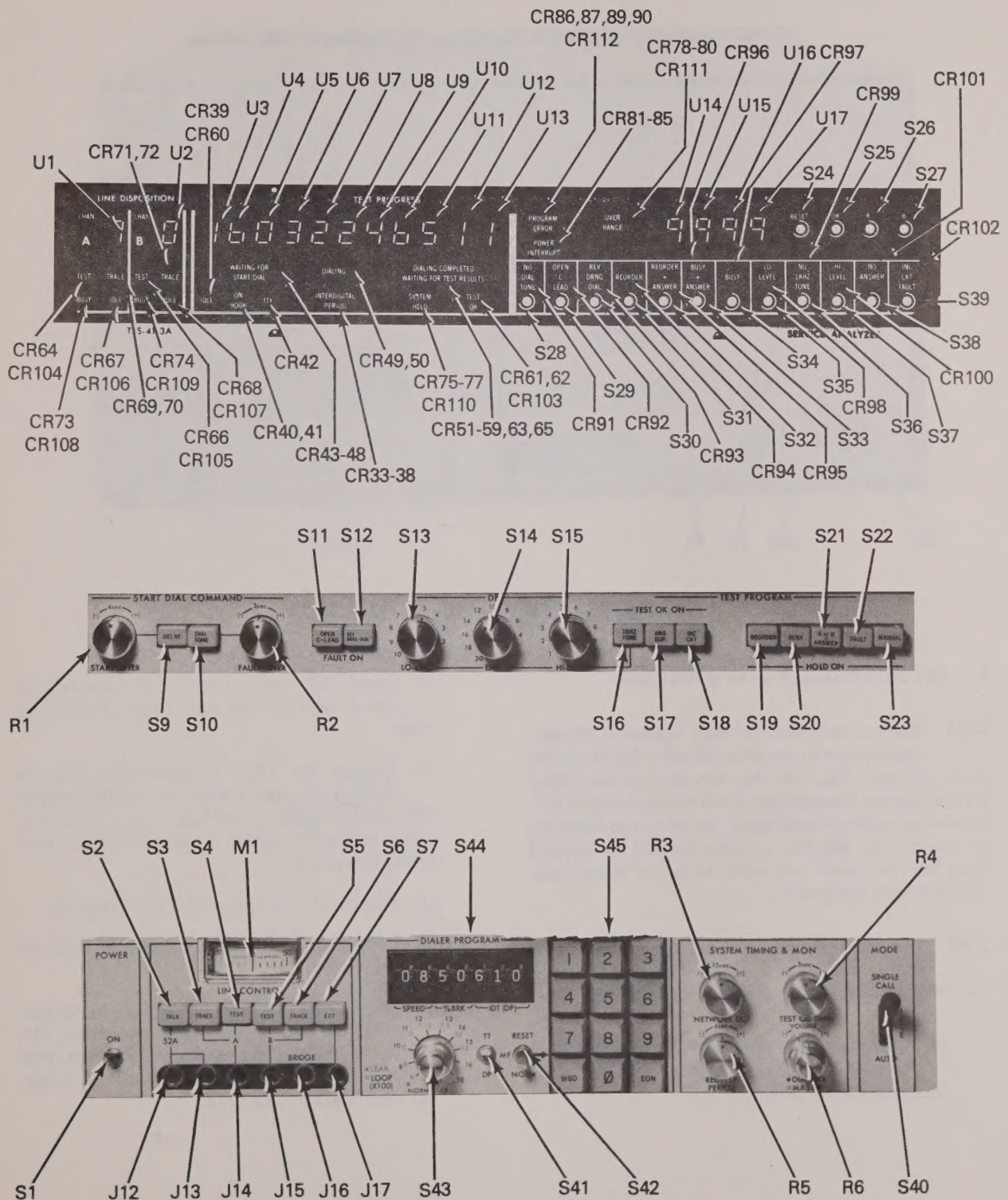


Fig. 18—Front Panel Controls and Indicators

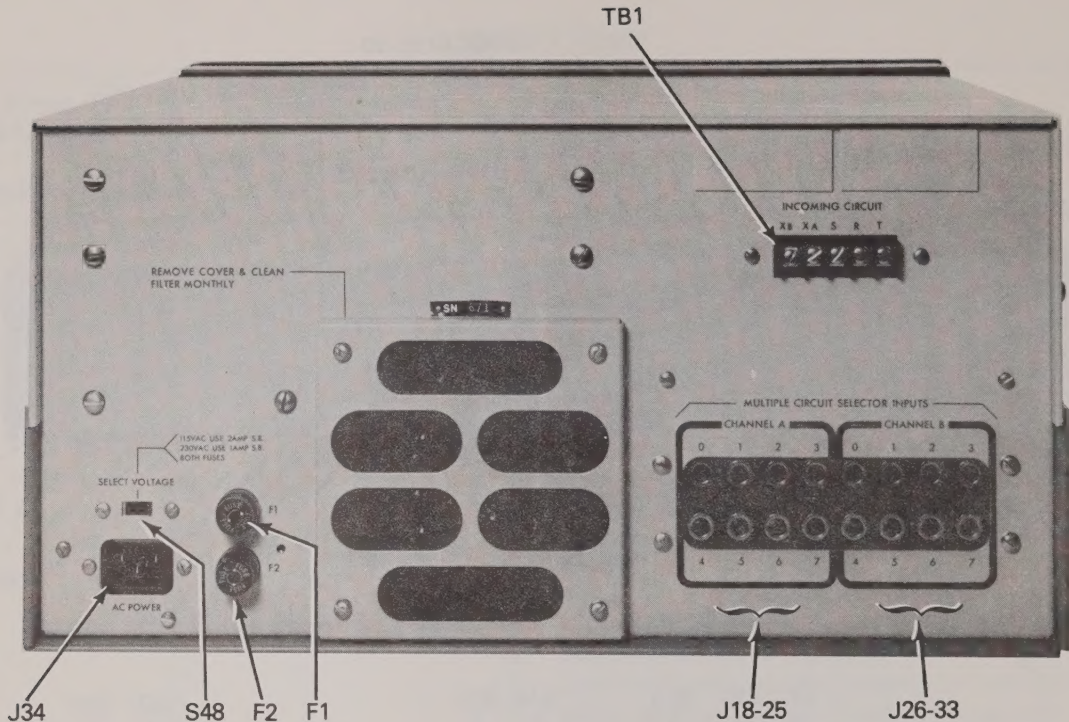


Fig. 19—Rear Panel Connectors

E. EXT Jack Connection to a Held Line

3.91 The analyzer automatically applies a 735-ohm termination to the selected call origination line when off-hook. This 735-ohm termination can affect testing (such as transmission level measurements) performed by external equipment. By using the following procedure, the 735-ohm termination can be isolated from the line under test while tests are being made with external equipment.

3.92 To make transmission level measurements (or similar tests) with external equipment on a line held by the analyzer, perform the following steps.

- (1) Using a patch cord with a type 310 plug, connect the external test equipment to the analyzer's EXT jack.
- (2) Select the required termination/impedance and dc holding with the external test equipment.
- (3) Engage the TRACE pushbutton for the channel associated with the line under test. (This action applies a holding circuit to the line under test while the line is being switched to external equipment.)
- (4) Engage the analyzer's EXT pushbutton.
- (5) Release the TRACE pushbutton engaged previously.
- (6) The external equipment should now be providing dc holding for the line under test. The analyzer's 735-ohm termination is isolated from the line. Tests can be performed with the external equipment at this time.



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